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ABSTRACT

This curriculum guide was developed as a result of a project conducted in Pennsylvania to review, update, and revise the vocational-technical curriculum for cardiovascular technologists. The guide is organized in five sections. The first section describes the project, while the second section lists the minimum essentials for a cardiovascular technology program according to the Committee on Allied Health Education and Accreditation (CAHEA). In the third section, the CAHEA essentials are applied to a proposed cardiovascular technology program. This section contains the proposed two-year curriculum, core course descriptions, cardiovascular technician course descriptions, core course objectives, cardiovascular course objectives for anatomy and physiology, pathology, pharmacology, instrumentation, and cardiovascular practicum. The fourth section contains clinical checklists for evaluation of student performance of technical skills. The fifth section is a bibliography. (KC)

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FINAL REPORT

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A CURRICULUM GUIDE FOR
CARDIOVASCULAR TECHNOLOGIST

CONTRACT NUMBER: 85-7014

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SECTION 1

INTRODUCTION AND PURPOSE OF THE GRANT PROPOSAL

RATIONALE

In the Fall of 1985, the National Society for Cardiopulmonary Technology, Inc. (NSCPT), noted in the Introduction section of their proposed essentials for an approved educational program that there were 30,000 cardiopulmonary technicians practicing in the United States. They went on to mention that many of these practitioners were not credentialed and most were "on-the-job" trained, having little formal health care educational experiences.

They went on to note that the small number of existing traditional programs has not and will not be able to meet the nationwide demands of their developing profession. The NSCPT mentioned that the need exists for unique programs that will bring additional Pulmonary Technologists into their credentialing process.

The NSCPT also noted that as professional opportunities in their field increased, additional well trained, credentialed technicians would be needed. In response to their statements, Harrisburg Area Community College (HACC) has proposed that a special set of educational materials be developed which will attract individuals into this growing field and update the skills of those hoping to obtain the credentials of a Pulmonary or Cardiovascular Technologist. Individuals currently employed in a related allied health field who desire these credentials are included in the target population.

This proposal is necessary to allow for the development and implementation of a new curriculum and curriculum materials currently required in order to address unmet community needs. That need, which is the development of competency-based vocational education (CBVE) curriculum materials in Cardiopulmonary Technology, is designed to be satisfied upon the completion of this one year developmental period.

This proposal is addressing a continuing need brought about by a shortage of qualified graduates familiar with the medical technology devices and procedures currently being utilized by hospitals and medical centers. This program in Cardiopulmonary Technology is being proposed to provide the health-care agencies within Pennsylvania with employees that possess the experience and training requirements of a Cardiovascular or Pulmonary Technologist. The curriculum materials to be developed and implemented will be competency-based and may be utilized in a new vocational education program at the Harrisburg Area Community College. During the time period between July 1, 1986, and June 30, 1987, curriculum materials will be developed in accordance with the instructional units appearing in the accreditation standards listed by the National Society for Cardiopulmonary Technology, Inc. (NSCPT) and the Committee on Allied Health Education and Accreditation (CAHEA).

These materials are a critical component of a retraining and upgrading program being proposed at the College for individuals in cardiopulmonary technology who are currently underemployed. Other individuals, in related health care technologies, may also be able to utilize these materials in an effort to upgrade their skills and become available for positions requiring additional technical abilities.

The need for employees who have utilized these materials should begin to be met as students fulfill the graduation requirements after October 1, 1987. If a program is initiated by the Harrisburg Area Community College during the 1988-1989 academic year, then the first full class of non-advance standing students should graduate during the 1989-1990 academic year.

Students hoping to utilize these materials upon their completion in October, 1987, will be those who have received an "advance standing" Status. Those that are awarded advance status, based on prior work and college experiences, may apply for graduation as soon as (1) HACC's Cardiopulmonary Technology Program receives a certificate of accreditation from CAHEA, and (2) the students fulfill the graduation requirements.

The following factors have led HACC to ask for the funds to develop these type of materials:

- (1) A small number of accredited programs currently exist, none within Pennsylvania. Therefore, no instructional materials in the area of cardiopulmonary technology exist.
- (2) A large number of graduates of respiratory therapy programs reside within commuting distance of HACC and they are potential applicants for an accredited NSCPT or CAHEA program.
- (3) After interacting with the materials to be developed and receiving the additional clinical training required by the NSCPT, the graduates of respiratory therapy programs could become eligible for the Cardiovascular and/or Pulmonary Technologist credentialing examination.
- (4) On Friday, January 24, 1986, HACC's respiratory therapy advisory committee advised the College to investigate the possibility of implementing a Cardiopulmonary Technology Program which would allow employees within their departments to the necessary retraining to be upgraded as a Cardiovascular and/or Pulmonary Technologist.

To our knowledge, there has been only one attempt made by any of the Commonwealth's twenty-two (22) respiratory therapy educational programs to deal with the shortage of qualified Cardiovascular and/or Pulmonary Technologists. Therefore,

little attempt has been made to develop the necessary program materials needed for such an undertaking.

According to the employers serving as members of HACC's respiratory therapy advisory committee, the graduates of this program(s) who have utilized the competency-based materials and obtained the additional clinical training required by the NSCPT and CAHEA, will have the potential to become employed within the health care labor market.

This proposal has the potential to address the following State Goals and Subgoals for Vocational Education in Pennsylvania.

<u>Goal Number</u>	<u>Subgoal Number</u>	<u>Comment</u>
VI	6.3	A relevant, meaningful instructional program can be created if new curriculum materials can be developed.
III	3.2	Financial assistance is needed by the College if this new program designed to update and upgrade those who are already employed and relying on CBVE materials, is to be established.

Specifically, the following is a list of objectives that this proposal would fulfill.

- (1) To develop competency-based vocational education (CBVE) curriculum materials which will be utilized as part of an educational plan to meet Central Pennsylvania's unmet needs for qualified cardiopulmonary technologists.
- (2) To obtain an accreditation certificate from CAHEA for the program utilizing the CBVE materials to be developed by the personnel funded by this project.
- (3) To generate listing sites willing to participate as affiliates with this program where the CBVE materials will also be utilized.
- (4) To generate a data base of non-trained and under-trained individuals willing to enroll in a cardiopulmonary technology program and interact with the CBVE materials developed through the funding of this project.
- (5) To review the educational activities found within currently accredited cardiopulmonary technology programs and inspect the types of CBVE materials in use at those programs.

SECTION 2

PRESENTATION OF THE MINIMUM ESSENTIALS
ACCORDING TO THE COMMITTEE ON ALLIED HEALTH
EDUCATION AND ACCREDITATION

ESSENTIALS AND GUIDELINES OF AN ACCREDITED EDUCATIONAL PROGRAM FOR THE CARDIOVASCULAR TECHNOLOGIST¹

DESCRIPTION OF THE PROFESSION

Cardiovascular technology is an allied health profession specifically concerning the diagnosis and treatment of patients with cardiac and peripheral vascular disease. The technologist performs examinations at the request or direction of a physician. The technologist is proficient in the use of analytical equipment and sundry apparatus including placing such equipment on or into the patient or placing the patient on the equipment. It is not the intent that the cardiovascular technologist be trained to expose patients to ionizing radiation. Through subjective sampling and/or recording, the technologist proceeds with the examination to create an easily definable foundation of data from which a correct anatomic and physiologic diagnosis may be established for each patient.

The profession of cardiovascular technology encompasses the three areas of diagnostic evaluation: 1) invasive cardiology; 2) noninvasive cardiology; and 3) noninvasive peripheral vascular study.

Expertise in one area does not imply expertise in other areas.

The procedures performed by the cardiovascular technologist may be found in, but are not limited to, one of the following general settings:

1. Invasive cardiovascular laboratories, including cardiac catheterization, blood gas and electrophysiology laboratories.
2. Noninvasive cardiovascular laboratories including echocardiography, exercise stress test and electrocardiography laboratories.
3. Noninvasive peripheral vascular studies laboratories including Doppler ultrasound, thermography and plethysmography laboratories.

¹Essentials are the minimum standards for accrediting educational programs that prepare individuals to enter an allied health profession recognized by the American Medical Association. The extent to which a program complies with these standards determines its accreditation status; the Essentials therefore include all requirements for which an accredited program is held accountable. Essentials are printed in regular typeface in outline form.

Guidelines assist programs in complying with the Essentials by providing examples of how general statements in Essentials may be interpreted. *Guidelines* are printed in italic typeface in narrative form.

SCOPE OF ACCREDITATION

- A. Cardiovascular technology educational program will encompass one or more of the three basic areas of expertise: invasive cardiology, noninvasive cardiology, or noninvasive peripheral vascular study.
- B. Applicants for accreditation of cardiovascular technology programs must specify the area or areas of specialization for which accreditation is being sought. Accreditation in one area does not imply accreditation in other areas. Lists of accredited programs must indicate the specific areas for which accreditation has been granted.

SPONSORSHIP

- A. The sponsoring institution and affiliates, if any, must be accredited by recognized agencies or meet equivalent standards.
- B. Accredited educational programs may be established in:
 - 1. Community and junior colleges, senior colleges and universities.
 - 2. Hospitals and clinics.
 - 3. Medical schools.
 - 4. Postsecondary vocational/technical schools and institutions.
 - 5. Other acceptable institutions which meet comparable standards for education in this field.

Acceptable "postsecondary vocational/technical schools and institutions" include vocational or technical schools accredited by regional accrediting associations or by other comparable and appropriate accrediting agencies. Institutional accreditation established evidence that the program sponsor meets recognized professional standards for its primary mission. This same evidence should also be the basis for determining whether or not an institution meets "comparable standards."

Sponsoring institutions utilizing clinical education centers are expected to insure that these health care facilities are comparably and appropriately accredited. These centers should have such facilities as a peripheral vascular studies laboratory, a noninvasive cardiology laboratory, cardiac catheterization laboratory, an open heart surgery program, and emergency room as well as critical care facilities.

- C. In programs where the academic and clinical education are provided by two or more institutions, accreditation is granted to the institution that assumes primary responsibility for curriculum planning and selection of course content; coordinates classroom teaching and supervised clinical education; appoints faculty to the program; receives and processes applications for admission; and grants the degree or certificate documenting completion of the program. The sponsoring institution shall also be responsible for assuring that activities assigned to students in the clinical setting are educational.

Sponsoring institutions are expected to demonstrate accountability to the public, students and the medical profession for an effective, valid, and legitimate educational process. Sponsoring institutions should indicate on the degree or certificate the area or areas of expertise acquired.

- D. Responsibilities of the sponsor and each affiliate must be clearly described in written documents, such as affiliation agreements.

A written affiliation agreement should be signed by the appropriate institutional officers, and clearly delineate the responsibilities of students and of each institution with regard to student supervision, benefits, liability and financial arrangements, if any. Each institution should retain a copy of the written agreement

RESOURCES

A. General Resources

Resources must be adequate to support the number of students who are admitted to the program. The instructor/student ratio shall be adequate to achieve the stated objectives of the curriculum.

Clinical training should, wherever possible, be on a one-to-one ratio. Clinical faculty should be responsible for scheduling, supervising and testing of no more than ten (10) students per instructor per course of instruction.

B. Personnel

1. Program Officials

The program must have at least two qualified program officials--a program director and a medical director. In accordance with institutional policies and practices, these officials shall possess the qualifications and assume the responsibilities described below.

a. Program Director

i. Responsibilities

The program director's duties include the organization, administration, periodic review, continued development and general effectiveness of the program. The program director shall provide supervision, administration and coordination of the instructional staff in the academic and clinical phases of the educational program.

The program director has responsibility for the daily operation of the program as well as assessing its appropriateness in terms of education, operating structure and incorporating new concepts and techniques. In addition, this person is responsible for maintaining the quality of the program.

ii. Qualifications

The program director must be a qualified faculty member and possess a higher level of education and/or professional experience than that for which the students in the program are being prepared.

A qualified program director should possess the necessary academic prerequisites and clinical experience in cardiovascular technology that are in accordance with the normal requirements for faculty members of the sponsoring institution.

b. Medical Director

i. Responsibilities

The medical director of the program shall provide competent medical guidance to ensure that the medical component of the curriculum, both didactic and supervised practice, meets current acceptable standards.

ii. Qualifications

The medical director must be a currently licensed physician who is experienced in the diagnosis of cardiac and/or vascular disease and must be knowledgeable and effective in teaching the subjects assigned.

2. Instructional Staff

a. Responsibilities

All instructional staff members are responsible for the particular course or courses they teach. This includes responsibilities for providing an updated course outline on a regular basis, selecting textbooks and administering adequate testing. The clinical education site(s) must have adequate clinical instructors responsible for evaluating the clinical competencies of students and maintaining appropriate records to verify that these competencies have been ably demonstrated.

b. Qualifications

The instructors must be knowledgeable and effective in teaching the subjects assigned.

All faculty members, regardless of the extent of their participation, should be familiar with the goals of the program and should be able to demonstrate the ability to develop an organized plan of instruction and evaluation.

Important criteria for employment of faculty should include; a) knowledge of subject matter, b) ability to organize and present the subject, c) positive attitude toward teaching and d) participation in continuing education designed to improve instructional skills and maintain professional competence.

3. Professional development

Programs shall encourage continuing education in cardiac and vascular technology developments and continuing professional growth to ensure that program faculty and officials can fulfill the responsibilities delineated in the Essentials.

C. Financial Resources

Financial resources shall be assured to fulfill obligations to enrolled students.

The budget should reflect sound educational priorities with a high priority assigned to the improvement of the educational process.

D. Physical Resources

1. Facilities

Adequate classrooms, laboratories, administrative offices and other facilities shall be provided.

2. Equipment and Supplies

Equipment, accurately calibrated and in good working order and meeting applicable national and state standards, if any, must be available for the full range of diagnostic procedures for which the program is seeking accreditation. Appropriate multimedia materials and other instructional aids, including clinical and reference materials, must be available.

Clinical sites should have state-of-the-art equipment available to students during their clinical rotations. The clinical sites may be used to augment the diagnostic equipment found at the site of the sponsoring institution.

3. Library

Students shall have ready access to an adequate supply of up-to-date books, periodicals, journals, and other reference materials related to the curriculum.

The library maintained by the sponsoring institution should own enough printed and other media holdings to accommodate required study, promote independent study and research and to aid faculty in delivering and improving the program. Clinical affiliates should allow students access to reference materials for support of their clinical assignments. The faculty should be encouraged to participate in the selection of library materials. A list of holdings at both the educational institution and at the clinical education sites should be available to students and staff.

CURRICULUM

- A. Cardiovascular technology is a multidisciplinary science requiring the student to be suitably trained and educated in the basic and applied principles of several diagnostic and/or therapeutic modalities. Upon completing of an educational program, each student must have acquired clinical skills and knowledge consistent with specific clinical performance objectives in one or more of the following areas of expertise: Invasive Cardiology, Noninvasive Cardiology and Noninvasive Peripheral Vascular Studies.
- B. Instruction must follow a plan which documents a structured curriculum, including clinical education, with clearly written course syllabi which adequately describe learning objectives and competencies to be achieved.
- C. There shall be didactic courses and structured clinical experiences.
- D. There shall be sufficient laboratory courses to familiarize all students with basic technologic equipment and procedures appropriate to the clinical specialty prior to entry into the clinical phase of the program.
- E. Curriculum Length
 - 1. For the high school graduate without previous postsecondary education, the course of study shall normally span a period of 24 months and consist of one year of core courses followed by a year of instruction for each area of specialization.
 - 2. For the individual previously qualified in a clinically related allied health profession and meeting the curriculum course requirements, the professional curriculum shall normally be one calendar year in length for each area of specialization. These programs shall be conducted within a hospital environment or a combination of academic and clinical settings.

F. The curriculum must be comprised of at least the three major areas of:

1. Basic units of instruction
2. Cardiac and vascular units of instruction
3. Clinical instruction

Basic Units of Instruction

Suggested areas of instruction should combine both didactic instruction and structured laboratory experiences. The students should acquire a clear understanding of the basic sciences and how basic scientific principles relate to clinical applications in the cardiovascular technology field.

Suggested areas of instruction in the core curriculum:

- *Introduction to the Field of Cardiovascular Technology including patient care techniques and the hospital environment*
- *General and/or Applied Sciences-including biology, basic chemistry, physical principles of medicine, basic statistics and general mathematics at a level approaching that of intermediate algebra*
- *Human Anatomy and Physiology-with emphasis on cardiac and vascular systems*
- *Basic Pharmacology-pertaining to cardiovascular drugs*
- *Basic Medical Electronics and Medical Instrumentation*

Related subjects may be selected from courses or course components in health care and general science that would meet established program objectives and goals and could enhance the professional ability of the cardiovascular technologist. These might include courses in reading comprehension, technical writing, research techniques, microbiology, interpersonal relationships, speech, and a foreign language.

Students who have mastered the basic areas of instruction may be brought to a higher level of understanding and confidence with a mixture of the required physiology, and electrical, physical, and clinical principles involved in the cardiovascular field. An opportunity should be provided to obtain the necessary level of knowledge and skills to properly operate and become thoroughly familiar with diagnostic and physiological instrumentation used in their particular clinical area of specialization.

Cardiac and Vascular Units of Instruction

The cardiac units of instruction include two major areas, invasive and noninvasive cardiology. The vascular units of instruction include subject matter relating to noninvasive peripheral vascular studies.

Clinical Instruction

The clinical units of instruction should include:

- Cardiac and Vascular Pathophysiology
- Patient History & Physical Examination
- Patient Psychology, Care and Communications
- Cardiopulmonary Resuscitation
- Therapeutic Measures
- Clinical Cardiac and Vascular Medicine
- Statistics, Management of Data
- Physics
- Medical-Legal Ethics

G. The curriculum shall be sufficient to provide:

1. Knowledge of the technical skills necessary to perform appropriate diagnostic cardiac or vascular testing;
2. An understanding of other diagnostic and interventional procedures as they relate to the clinical evaluation and treatment of cardiovascular disease;
3. Comprehension of the methodologies required to obtain correct data pertinent to the diagnostic procedures being performed;
4. An understanding of pertinent pharmacological effects that affect the cardiovascular status; and
5. A knowledge of the attendant risks to the patient of any of the procedures performed.

H. Areas of study for each of the three areas of diagnostic evaluation are listed below.

- Normally students will be educated and trained to become proficient in only one of these areas in any given 12 month period.

1. Invasive Cardiology

Recording and performing preliminary analysis of invasive cardiovascular data in procedures such as:

- a. Measuring cardiovascular parameters such as cardiac output, blood flow and velocity, cardiopulmonary hemodynamics, cardiac electrophysiology, shunts, valve areas, and heart sounds with appropriate diagnostic procedures.
- b. Conducting quantitative and qualitative analysis of arterial and venous blood gases.
- c. Preparing, calibrating and operating monitoring instrumentation utilized for determining the presence and extent of cardiovascular abnormalities in diagnostic laboratory or operating room settings.
- d. Collecting and preparing diagnostic test data for review by a physician.

2. Noninvasive Cardiology

Recording and performing preliminary analysis of noninvasive cardiovascular data in procedures such as:

- a. Echocardiography (M-Mode, Two-Dimensional, and Doppler Studies)

This component shall be approximately one year in length during the usual two year curriculum.

In a two year curriculum, echocardiography, along with the other noninvasive modalities listed, should be introduced during the students' first year. More detailed and specialized instruction in all the noninvasive modalities should be continued throughout the entire second year of the curriculum.

- b. Other noninvasive modalities including vectorcardiography, electrocardiography, exercise stress testing, ambulatory monitoring (Holter), phonocardiography, external pulse tracings and apexcardiography.
- 3. Noninvasive Peripheral Vascular Study
Recording and performing preliminary analysis of noninvasive peripheral vascular data in procedures such as:
 - a. The use of quantitative and qualitative methods of assessing arterial obstruction in the upper and lower extremities including the use of Doppler ultrasound, pneumoplethysmographic tracings, segmental pressure measurement, photoplethysmographic and strain gauge plethysmographic assessment of digits.
 - b. Quantitative and qualitative methods of detecting venous obstruction, venous reflux including use of Doppler ultrasound, impedance outflow plethysmography (electrical, strain gauge and pneumoplethysmographic) , and photoplethysmography (for reflux).
 - c. Quantitative and qualitative methods of determining the presence of cerebrovascular disease including Doppler ultrasound of periorbital arterial signals, ocular-plethysmography, carotid phonoangiography, continuous and pulsed Doppler ultrasound for audible assessment of the carotid artery, sound spectrum analysis of continuous and pulsed waveforms, A-mode imaging, and B-mode imaging.

The cardiovascular technologist is trained to perform the aforementioned tasks in various patient care settings. Each technologist is also trained in life support techniques.

I. Clinical Practicum

- 1. Clinical instruction must be well planned and documented. Students must be exposed to, and gain experience in, the use of a wide variety of diagnostic and monitoring instrumentation.
- 2. The program must ensure the student's mastery of the theory and practice of essential skills prior to the student's assuming clinical responsibilities.
- 3. Any external rotation of students in clinical sites must be carefully monitored. The program sponsor shall be carefully monitored. The program sponsor shall be able to demonstrate that the students are not essential to carry out the normal workload in the clinical setting.
- 4. Classroom presentations, discussion and demonstrations shall be utilized for effective didactic sessions.
- 5. Supervised experience and student demonstration of skills required in obtaining diagnostic data shall be included in the curriculum.
- 6. Evaluation of students to assess cognitive learning, problem solving skills, interpersonal skills, motor skills and clinical competencies shall be an on-going process throughout the program.
- 7. Competencies required for successful completion of the program shall be clearly delineated. The clinical education site must have clinical instructors who are responsible for evaluating the clinical competencies of students and for maintaining appropriate records verifying that the competencies have been satisfactorily demonstrated.
- 8. In the clinical setting 1) the student must be aware of the fact that the physician in charge has the ultimate authority and responsibility. 2) The student must be clearly identified as a student at all times. 3) Students must not take the responsibility, nor the place of, qualified staff. Students shall be permitted to perform procedures only under supervision.

STUDENTS

A. Information

Students shall be provided with a clear description of the field of cardiovascular technology with its occupational hazards and of the program and its content, including learning goals, course objectives, required competencies and supervised clinical education requirements.

Students should receive a description of the length of the program, the course material to be covered, and a description of the evaluation process prior to entry into the program. Individual course outlines defining course objectives, the schedule for courses, testing mechanisms, laboratory fees (if any) and the grading methods should be provided prior to the start of each course. Students should be informed of the clinical training that is available and the types of clinical training that they may pursue. Information regarding the length of the clinical practicum phase of their program, the types of hospitals or clinics that will be involved in such clinical practicum, the benefits deriving from such experience and training and the relationships between the didactic and the clinical training should all be explained to the students in an early phase of the program. Information regarding competency tests to be performed in the clinical area should be made available to each student prior to the beginning of a particular clinical course or phase of the program. Students should be informed about appropriate safety procedures to be followed throughout the course of study and the reasons for them.

B. Admission

Admissions of students, including advanced placement, shall be made in accordance with the clearly defined and published practices of the institution. Any specific academic and technical standards required for admission to the program shall also be clearly defined and published.

Admissions criteria covering the selection of students should be periodically reviewed and validated, based on student outcomes reflected in evaluations of current students and follow-up studies of graduates. The program may choose to have an admissions committee. Selection criteria should be evaluated periodically to determine what effect they have had on student performance or attrition.

C. Evaluation

Criteria for successful completion of each segment of the curriculum and for graduation shall be given in advance to each student. Evaluation systems shall include content related to the objectives and competencies described in the curriculum for both didactic and supervised clinical education components. These shall be employed to provide both students and program officials with indications of the students' academic standings and progress.

The evaluation system for all phases of the program should be related to the educational objectives and be employed with such frequency so as to provide ongoing and terminal evaluations. The evaluation process should serve as a reliable indicator of the effectiveness of instruction and course design. The criteria for successful performance should be equitably applied without discrimination and provision should be made for remedial programs or dismissal after due process for students who do not make satisfactory academic progress according to these criteria. A standardized objective system to evaluate and document the students' clinical progress should be utilized in order to provide developmental assistance to correct weaknesses. Students should demonstrate to qualified supervisors their competence in carrying out appropriate

assignments. Clinical records should provide baseline data for a competency-based clinical education evaluation system. They should therefore identify the required competency, the experiences undertaken to achieve the competency, evaluations by qualified personnel of the achievement of the competency and progression of the students in achieving proficiency.

D. Health

The program officials shall be responsible for determining that the applicants' or students' health will permit them to meet the written technical standards of the program. Students must be informed of and have access to the usual student health care services of the institution, including emergency health services and psychological counseling services where available. While it is not the intent that students be trained to expose patients to ionizing radiation, students must be protected against and monitored for exposure to ionizing radiation during their clinical rotations in cardiac catheterization or cardiovascular nuclear studies laboratories.

It should be of major concern that every program provide healthy care or develop some mechanism for students to obtain adequate health care insurance at reasonable group rates.

E. Guidance

Student guidance shall be available, to include assisting students in understanding and abiding by program policies and practices and providing counseling or referral for student with personal problems that may interfere with their progress in the program.

Programs should have student guidance procedures that include documentation of regular and timely discussion with qualified faculty of student strengths, weaknesses, and progress in the program; and providing evidence that students are informed of fair practices/due process with regard to admission/retention policies, unfavorable evaluations, and disciplinary policies such as those for suspension and dismissal.

OPERATIONAL POLICIES

A. Fair Practices

1. Announcements and advertising must accurately reflect the program offered.

Student recruitment practices should permit students to exercise free choice of program.

Student recruitment practices should not be misrepresentative.

Misleading advertising concerning job placement should be avoided. The students should be informed of the employment opportunities that may be available upon graduation. The program should make available information relating to the program. This material should indicate the availability of the following items:

- Certification information
- Vacation and compensatory time policies
- Standards of conduct and performance
- Disciplinary policies and procedures
- Policy regarding leaves of absence

2. Student recruitment and admission practices and student and faculty recruitment and employment shall be nondiscriminatory with respect to race, color, creed, sex, age handicaps, or national origin.

Reasonable accommodation should be provided to handicapped applicants within the obvious limitations that the cardiovascular technology field imposes.

3. Academic credit and cost to the student shall be accurately stated and published.
4. Policies and processes for student withdrawal and refunds of tuition and other fees shall be published and made known to all applicants.

Tuition and fees should be consistent with institutional policies; if credit hours are the basis for tuition, the number of credits required in the program should be consistent with the degree granted.

Financial arrangements should be fair to the students and to the schools.

- Student loan programs or contracts should be explained in program publications.
- Grant procedures and policies should be published and made known to the student applicant.

5. Policies and processes by which students may perform service work while enrolled in the program must be published and made known to all concerned in order to avoid practices in which students are substituted for regular staff. Students may be employed in the field of study outside regular educational hours provided the work is limited so that it does not interfere with regular academic responsibilities. The work must be noncompulsory, paid, and subject to employee regulations.

B. Student Records

Satisfactory records shall be maintained for student admission, attendance, participation, and evaluation. Grades and credits for courses shall be recorded on the student transcript and permanently maintained by the sponsoring institution.

Provision should be made for permanent retention of student transcripts in the event that the program and/or sponsoring institution should discontinue operations.

PROGRAM EVALUATION

- A. The program must have a continuing system for periodically and systemically reviewing the effectiveness of the program, including a formal self-study and the Self-Study Report required by the accreditation review process.
- B. The results of program evaluation must be appropriately reflected in review of the curriculum and other elements of the program with appropriate revision.

Program evaluation should include a continuing system for internal and external curriculum validation, including evaluation by current and former students; follow-up studies of alumni, such as employment and examination performance; and input from advisory groups, such as admission, curriculum, and advisory committees.

MAINTAINING AND ADMINISTERING ACCREDITATION

A. Program/Sponsoring Institution Responsibilities

1. Applying for Accreditation

The accreditation review process conducted by the Committee on Allied Health Education and Accreditation (CAHEA) can be initiated only at the written request of the chief executive officer or an officially designated representative of the sponsoring institution.

This process is initiated by requesting an application form from and returning it to:

Division of Allied Health Education and Accreditation
American Medical Association
535 North Dearborn Street
Chicago, Illinois 60610

A program or sponsoring institution may at any time prior to the final accreditation action withdraw its request for initial or continuing accreditation.

2. Maintaining Accreditation

Programs are required to comply with administrative requirements for maintaining accreditation, which include:

- a. Submitting the Self-Study Report or a required progress report within a reasonable period of time, as determined by the review committee.
- b. Agreeing to a reasonable site visit date before the end of the period for which accreditation was awarded.
- c. Informing the review committee within a reasonable period of time when new personnel required by the Essentials are appointed.
- d. Paying review committee fees within a reasonable period of time, as determined by the review committee.
- e. Completing and returning by the established deadline the Annual Report provided by CAHEA.

Failure to meet these administrative requirements for maintaining accreditation may lead to being placed on Administrative Probation and ultimately to having accreditation withdrawn.

B. CAHEA/Review Committee Responsibilities

1. Administering the Accreditation Review Process

At the written request of the chief executive officer or an officially designated representative, the Committee on Allied Health Education and Accreditation and the Joint Review Committee will review educational programs to assess compliance with the Essentials. The accreditation review process includes a site visit. If the performance of a site visit team is unacceptable, the institution may request a second site visit.

Before the review committee forwards its recommendation to CAHEA, the program being reviewed is given an opportunity to review the findings and conclusions of the site visit team and to comment on their accuracy.

Prior to recommending Probationary Accreditation to CAHEA, the review committee provides the sponsoring institution with a second opportunity to respond to the cited deficiencies. Review committee reconsideration of a recommendation for Probationary Accreditation will be made only on the basis of conditions existing when the review

committee arrived at its accreditation to CAHEA and on subsequent documented evidence of corrected deficiencies.

CAHEA assignments of Probationary Accreditation, including those following review committee reconsideration, are final and are not eligible for further appeal.

2. Withholding or Withdrawing Accreditation

Prior to recommending Accreditation to CAHEA, the review committee will provide the sponsoring institution with an opportunity to request reconsideration by the review committee. CAHEA decisions to withhold or withdraw accreditation are final unless appealed to CAHEA. A copy of the CAHEA Appeals Procedures for Accreditation Withheld or Withdrawn is included in the letter notifying the program of one of these actions.

When accreditation is withdrawn, the appropriate official is provided with a clear statement of each deficiency and is informed that application for accreditation as a new applicant may be made whenever the program is believed to be in substantial compliance with the Essentials.

All students successfully completing a program granted any accreditation category at any point during their tenure as students are regarded as graduates of a CAHEA-accredited program.

3. Inactive Programs

Programs that do not enroll students for one or two years are designated as inactive. Such programs must continue to pay annual fees to the review committee. After being inactive for two years, the program will be considered as discontinued, and accreditation may be withdrawn.

SECTION 3

CAHEA ESSENTIALS APPLIED TO THE PROPOSED
CARDIOVASCULAR TECHNOLOGY PROGRAM

CARDIOVASCULAR TECHNOLOGY CURRICULUM

<u>Summer (Yr. 1)</u>		<u>Fall (Yr. 1)</u>		<u>Spring (Yr. 1)</u>	
Intro Biology	3.0	Elective	3.0	CV Practicum	3.0
College Algebra	3.0	Intro Chemistry	3.0	Physics	4.0
Composition 1	3.0	CV Physiology	3.0	Speech 1	3.0
Anatomy/Physiology	4.0	Anatomy/Physiology	4.0	Composition 2	3.0
13.0		13.0		13.0	

Summer (Yr. 1)

CV Instrumentation	4.0
CV Pathophysiology	3.0
CV Pharmacology	3.0
Elective	3.0

13.0

<u>Non-Invasive Track</u>		<u>Invasive Track</u>		<u>Peripheral Track</u>	
<u>Fall (Yr. 2)</u>		<u>Fall (Yr. 2)</u>		<u>Fall (Yr. 2)</u>	
CV Instrumentation	3.0	CV Instrumentation	3.0	CV Instrumentation	3.0
CV Conjoint Science	2.0	CV Conjoint Science	2.0	CV Conjoint Science	2.0
CV Rotation	6.0	CV Rotation	6.0	CV Rotation	6.0
Proficiency Testing	1.0	Proficiency Testing	1.0	Proficiency Testing	1.0
12.0		12.0		12.0	

<u>Spring (Yr. 2)</u>		<u>Spring (Yr. 2)</u>		<u>Spring (Yr. 2)</u>	
CV Instrumentation	3.0	CV Instrumentation	3.0	CV Instrumentation	3.0
CV Special Topics	2.0	CV Special Topics	2.0	CV Special Topics	2.0
CV Rotation	8.0	CV Rotation	8.0	CV Rotation	8.0
Proficiency Testing	1.0	Proficiency Testing	1.0	Proficiency Testing	1.0
14.0		14.0		14.0	

CORE COURSE DESCRIPTIONS

INTRODUCTORY BIOLOGY

Designed for the Allied Health areas. Topics should include basic biochemical and biophysical principles, the cell, human genetics, and systems of the human body. No prerequisite.

COLLEGE ALGEBRA

Fundamental algebraic operations; exponents and radicals; systems of equations; higher degree equations; logarithms; matrices; inequalities. Prerequisite: Two years of high school algebra or Beginning and Intermediate Algebra.

COMPOSITION 1

The development of fluency in writing clear, forceful, effective prose. Prerequisite: Placement through Competency Examination or completion of an English Essentials course with a grade of C or higher.

COMPOSITION 2

Continuation of Composition 1. Emphasis on writing argumentative essays. Prerequisite: Composition 1 with a grade of C or higher.

CHEMISTRY 1

A beginning course in chemistry for students desiring an introduction to chemistry or requiring a course to update their knowledge of chemistry. Fundamental principles covered should be bonding, atomic structure, molecular structure, solutions: introduction to chemical nomenclature and stoichiometry. Prerequisite: Intermediate Algebra or higher level Mathematics.

PHYSICS 1

A beginning course in physics for allied health professions. Major topics include mechanics, atomic structure, radioactivity and its production, electromagnetic waves, direct and alternating current and magnetism. A weekly laboratory should be included.

Prerequisite: College Algebra or equivalent.

SPEECH 1

An introduction to oral communication with emphasis on helping the student increase competence as a communicator in interpersonal, small group, and public speaking contexts.

ELECTIVE #1

A social or behavioral science course is recommended.

ELECTIVE #2

A communications or arts course is recommended.

CARDIOVASCULAR TECHNOLOGY **COURSE DESCRIPTIONS**

ANATOMY AND PHYSIOLOGY 1

Intended for students who contemplate careers in Allied Health fields; basic body organization; functional biochemistry; cytology, histology; study of integumentary, skeletal, muscular, circulatory, and respiratory systems; emphasis on the study of normal anatomy and physiology with clinical applications. Prerequisite: High school biology and chemistry or college equivalent.

ANATOMY AND PHYSIOLOGY 2

A continuation of Anatomy and Physiology 1. A comprehensive study of the digestive, excretory, endocrine, reproductive, and nervous systems. Prerequisite: Anatomy and Physiology 1 with a grade of C or higher.

CARDIOVASCULAR PHYSIOLOGY

An intensive course with emphasis on the cardiopulmonary system including circulatory dynamics, electrophysiology, respiratory mechanics and blood buffering systems. Prerequisite: Introductory Biology, Anatomy and Physiology 1 & 2, or college equivalent with grades of C or higher.

CARDIOVASCULAR PATHOPHYSIOLOGY

A continuation of Cardiovascular Physiology with emphasis on the pathophysiological mechanisms of congenital and acquired diseases of the cardiopulmonary system. Prerequisite: Cardiovascular Physiology with a grade of C or higher.

CARDIOVASCULAR PHARMACOLOGY

An intensive course with emphasis on the principles of basic pharmacology as applied to the cardiopulmonary system. The pharmacological effects of the common classes of drugs used in patient care and their effects on cardiovascular studies will be presented. Prerequisite: Cardiovascular Physiology with a grade of C or higher.

CARDIOVASCULAR INSTRUMENTATION 1

An intensive survey course with emphasis on the basic instrumentation used in non-invasive, invasive, and peripheral vascular studies. The student's understanding is broadened in basic physical principles, basic electronics, the metric system, radiation, calculations, and accurate use of basic analytical equipment as they apply to cardiovascular technology. Prerequisite: Physics 1, Anatomy and Physiology 1 & 2, Cardiovascular Physiology or college equivalents with grades of C or higher.

CARDIOVASCULAR INSTRUMENTATION 2.1

A continuation of Cardiovascular Instrumentation 1 with an emphasis on advanced instrumentation and procedures used in non-invasive vascular studies. Prerequisite: Student chooses the non-invasive cardiovascular technology track, and completion of Cardiovascular Instrumentation 1 with a grade of C or higher.

CARDIOVASCULAR INSTRUMENTATION 2.2

A continuation of Cardiovascular Instrumentation 1 with an emphasis on advanced instrumentation and procedures used in invasive vascular studies. Prerequisite: Student chooses the invasive cardiovascular technology track, and completion of Cardiovascular Instrumentation 1 with a grade of C or higher.

CARDIOVASCULAR INSTRUMENTATION 2.3

A continuation of Cardiovascular Instrumentation 1 with an emphasis on advanced instrumentation and procedures used in peripheral vascular studies. Prerequisite: Student chooses the peripheral cardiovascular technology track, and completion of Cardiovascular Instrumentation 1 with a grade of C or higher.

CARDIOVASCULAR INSTRUMENTATION 3.1

A continuation of Cardiovascular Instrumentation 2.1 to include the latest advances in the non-invasive cardiovascular technology field. Prerequisite: Cardiovascular Instrumentation 2.1 with a grade of C or higher.

CARDIOVASCULAR INSTRUMENTATION 3.2

A continuation of Cardiovascular Instrumentation 2.2 to include the latest advances in the invasive cardiovascular technology field. Prerequisite: Cardiovascular Instrumentation 2.2 with a grade of C or higher.

CARDIOVASCULAR INSTRUMENTATION 3.3

A continuation of Cardiovascular Instrumentation 2.3 to include the latest advances in the peripheral cardiovascular technology field. Prerequisite: Cardiovascular Instrumentation 2.3 with a grade of C or higher.

CARDIOVASCULAR PRACTICUM

A survey of the cardiovascular technology field where the students observe and assist in non-invasive, invasive, and peripheral vascular laboratories. The student also studies the assessment of vital signs, medical history information gathering, and hospital documentation procedures. This course is intended to be an overview of the cardiovascular technology field so that the student can decide which cardiovascular track to pursue by the end of the spring semester of the first year. Prerequisite: Anatomy and Physiology 1 & 2 and Cardiovascular Physiology with a grade of C or higher and current certification by the American Heart Association in Cardiopulmonary Resuscitation.

CONJOINT CARDIOVASCULAR TECHNOLOGY

A lecture course intended to familiarize the student with topics not covered by any previous course to date. Various topics may be presented such as patient diseases and their effects on cardiovascular studies, etc.. Prerequisite: Cardiovascular Instrumentation 1 with a grade of C or higher.

CARDIOVASCULAR TECHNOLOGY ROTATION 1.1 & 1.2

A two semester course covering the principles of modern techniques used in the diagnosis and treatment of cardiovascular diseases with an emphasis in non-invasive cardiovascular testing procedures. Prerequisite: Cardiovascular Instrumentation 1 and Cardiovascular Practicum with a grade of C or higher.

CARDIOVASCULAR TECHNOLOGY ROTATION 2.1 & 2.2

A two semester course covering the principles of modern techniques used in the diagnosis and treatment of cardiovascular diseases with an emphasis in invasive cardiovascular testing procedures. Prerequisite: Cardiovascular Instrumentation 1 and Cardiovascular Practicum with a grade of C or higher.

CARDIOVASCULAR TECHNOLOGY ROTATION 3.1 & 3.2

A two semester course covering the principles of modern techniques used in the diagnosis and treatment of cardiovascular diseases with an emphasis in peripheral cardiovascular testing procedures.

Prerequisite: Cardiovascular Instrumentation 1 and Cardiovascular Practicum with a grade of C or higher.

CARDIOVASCULAR PROFICIENCY TESTING 1 & 2

A two semester course in which the student is expected to pass all proficiency testing procedures in their respective cardiovascular technology track as administered by the instructor. This course should include actual demonstration of techniques in a non-clinical situation in order for the student to gain confidence in the respective field prior to national certification examinations. Prerequisite: Cardiovascular Instrumentation 1 and Cardiovascular Practicum with a grade of C or higher.

SPECIAL TOPICS 1.1, 1.2 & 1.3

The student is expected to gain experience in researching disease conditions and successfully presenting case studies. A minimum of two different case studies is recommended.

CORE COURSE OBJECTIVES

INTRODUCTORY BIOLOGY

1. To familiarize students with basic biological principles and concepts related to the form and function of living things.
2. To familiarize students with terminology related to the life sciences, basic chemistry and the physical chemistry.
3. To familiarize the student with the basic principles of cell structure and function.
4. To familiarize the student with the basic principles of cellular metabolism in plant and animal systems.
5. To familiarize the student with the basic principles of biochemical regulation in mammalian systems.
6. To familiarize the student with the basic principles of mammalian genetics.
7. To familiarize the student with the mammalian organism by a review of systems.

COLLEGE ALGEBRA

1. To familiarize the student with fundamental algebraic operations.
2. To familiarize the student with scientific notation.
3. To familiarize the student with exponents and radicals.
4. To familiarize the student with systems of equations and higher degree equations.
5. To familiarize the student with logarithms.
6. To familiarize the student with matrices.
7. To allow the student to apply algebra to solving mathematical problems in the allied health field.

COMPOSITION 1 & 2

1. The student will demonstrate the ability to formulate ideas and express them in unified, coherent sentences.
2. The student will demonstrate the ability to compose paragraphs and short essays using proper grammar and spelling.
3. The student will demonstrate the ability to write fluent, clear, forceful, and effective prose.
4. The student will demonstrate the ability to write an argumentative essay.
5. The student will demonstrate the ability to write effective reports and technical papers.

INTRODUCTORY CHEMISTRY

1. To familiarize the student with the general inorganic chemical nomenclature and stoichiometry.
2. To familiarize the student with the fundamental principles of atomic bonding and structure.
3. To familiarize the student with the fundamental principles of molecular structure.
4. To familiarize the student with the concept of solutions and equilibrium.
5. To familiarize the student with the fundamental gas laws.
6. To introduce the student to general organic chemical nomenclature.

INTRO PHYSICS

1. To give the student a review of mathematics as applied to physical science.
2. To familiarize the student with the fundamentals of mechanics.
3. To familiarize the student with the fundamentals of electricity.
4. To familiarize the student with the fundamentals of magnetism.
5. To familiarize the student with the fundamentals of electromagnetic radiation.
6. To familiarize the student with the fundamentals of nuclear physics.
7. To provide the student with applications of the fundamental laws of physics to everyday experiences and the biological systems.
8. To provide the student with laboratory experience to emphasize the basic concepts of the physical sciences.

SPEECH

1. To increase the students ability to effectively communicate interpersonally.
2. To increase the students ability to effectively communicate in a small group.
3. To increase the students ability to effectively communicate in a public speaking context.
4. To provide the student with public speaking experience as related to the allied health field.

ELECTIVES

1. To allow the student to expand the knowledge in the area of a social or behavioral science of their own choosing.
2. To allow the student to expand the knowledge in the area of communications or arts of their own choosing.

CARDIOVASCULAR COURSE OBJECTIVES

ANATOMY AND PHYSIOLOGY

1. To review the basic concepts of general biology, including cellular structure, biochemical reactions, and cell regeneration.
2. To familiarize the student with the fundamental concepts of cellular histology.
3. To familiarize the student with the integumentary system.
4. To familiarize the student with the skeletal system.
5. To familiarize the student with the muscular system.
6. To familiarize the student with the cardiovascular system.
7. To familiarize the student with the component elements of blood and the concept of homeostasis.
8. To familiarize the student with heart structure and function.
9. To familiarize the student with circulation.
10. To familiarize the student with the lymphatic system.
11. To familiarize the student with the respiratory system.
12. To familiarize the student with the digestive system and all its related functions.
13. To review the concepts of metabolism to include carbohydrate, lipid, vitamin, and protein metabolism.
14. To familiarize the student with the urinary system.
15. To familiarize the student with the endocrine system.
16. To familiarize the student with the nervous system.
17. To familiarize the student with the reproductive system.
18. To provide sufficient laboratory time to learn the clinical aspects of dissection.

CARDIOVASCULAR PHYSIOLOGY

1. To learn the basic anatomy, structural relationships, and embryological development of the human heart and systemic circulation.
2. To learn the principles of Myocardial Dynamics.
3. To learn the principles of Electrophysiology.
4. To learn the principles of the Blood Buffering System.
5. To learn the principles of Respiratory Mechanics.
6. To learn the principles of Circulatory Control by the Nervous and Humoral regulatory systems.
7. To stress the interrelationship of the cardiac and pulmonary systems.
8. To demonstrate an understanding of the methods of hemodynamic data collection, calculation, and analysis.
9. To demonstrate the capability to perform hemodynamic data collection, calculation, and analysis using actual data.

CARDIOVASCULAR PATHOPHYSIOLOGY

1. To review the basic anatomy and physiology of the cardiopulmonary system.
2. To learn the pathophysiological mechanisms of congenital cardiovascular disease.
3. To learn the pathophysiological mechanisms of acquired cardiovascular disease.
4. To learn the pathophysiological mechanisms of congenital pulmonary disease.
5. To learn the pathophysiological mechanisms of acquired pulmonary disease.
6. To learn the basic principles of cardiopulmonary pharmacology and how these drugs aid in the of cardiopulmonary disease.
7. To recognize the laboratory and physical data associated with cardiopulmonary diseases and how this information is used to diagnose the affliction.
8. To recognize cardiopulmonary diseases when given clinical scenarios.
9. To learn the basic classes of drugs used to treat cardiopulmonary diseases.
10. To learn the mechanism of action of the basic classes of drugs used to treat cardiopulmonary diseases.

CARDIOVASCULAR PHARMACOLOGY

1. To understand the basic principles of pharmacology.
2. To list the basic classes of drugs used to treat cardiopulmonary disease.
3. To describe the mechanism of action of the basic classes of drugs used to treat cardiopulmonary disease.
4. To list the various types of pharmacological agents used in cardiovascular studies.
5. To describe the mechanism of action of the various types of pharmacological agents used in cardiovascular studies.
6. To demonstrate the correct method of writing a prescription.
7. To recognize the parts of a prescription.
8. To classify drugs according to a general mode of action in the body.
9. To recognize the drug interactions commonly seen in patients using undergoing cardiovascular studies.
10. To recognize the drug interactions of the major classes of drugs used clinically.

CARDIOVASCULAR INSTRUMENTATION - INVASIVE SECTION

1. The student will describe the standard cardiac catheterization techniques available.
2. The student will recognize normal intracardiac pressures and great vessel pressures.
3. The student will recognize normal intracardiac and vessel oxygen saturations.
4. The student will describe the standard theory and principles of radiologic and cineangiographic equipment.
5. The student will recognize and describe the significance of ST-T changes during coronary angiography.
6. The student will understand radiation safety and dosage.
7. The student will be able to describe and recognize catheterization complications, possible causes and preventions.
8. The student will recognize various catheters commonly employed during right and left heart procedures.
9. The student will describe the different techniques employed to determine cardiac output.
10. The student will recognize left ventricular contractile abnormalities.

11. The student will describe the purpose of coronary angioplasty.
12. The student will describe the purpose of streptokinase infusion.
13. The student will demonstrate the ability to correlate angiographic and clinical findings.
14. The student will describe the purpose of His Bundle recordings.
15. The student will describe pre and post-catheterization care of the patient.
16. The student will accurately recognize coronary arterial anatomy during angiography.
17. The student will recognize standard left and right ventricular radiographic views of the heart.
18. The student will accurately and efficiently collect all pertinent patient data according to standard laboratory procedure.
19. The student will accurately check and record history of patient allergies prior to any performed procedure.
20. The student will accurately check that appropriate consent forms are signed prior to performing the designated procedure.
21. The student will gather appropriate laboratory data, including chest X-rays, 12 lead ECGs, on the patient before performing a designated procedure.
22. The student will check that the proper premedications were administered and will accurately record the times of administration prior to performing a designated procedure.
23. The student will check for proper function and calibration of the defibrillator and that the defibrillator is turned on and function prior to performing a designated procedure.
24. During a procedure, the student will properly record catheter in-out times, fluoroscopy time, and medications administered during a performed procedure.
25. The student will accurately measure and record oxygen saturations according to standard laboratory procedure.
26. The student at all times shall remain alert to patient changes during a performed procedure.
27. The student shall maintain appropriate rapport with the patient before, during, and after a performed procedure.
28. The student will efficiently place any additional items into the sterile field during a performed procedure.
29. The student will assist in positioning a patient for coronary angiography.

30. The student will know the whereabouts of the urinal, bedpan, and emesis basin when performing a designated procedure.
31. The student will assist in returning the procedure room to functioning order after the designated procedure is finished.
32. The student will prepare a catheterization tray for sterilization according to standard laboratory procedure.
33. The student will accurately set up a sterile tray for a designated procedure.
34. The student will demonstrate sterile technique in gowning and gloving.
35. The student will efficiently demonstrate patient preparation according to standard laboratory procedure.
36. The student will efficiently demonstrate the ability to operate within and around a sterile field.
37. The student will demonstrate the ability to load a power injector and to set up a manifold and transducer according to standard laboratory procedure.
38. The student will accurately record a preliminary ECG.
39. The student will accurately record right heart pressures using proper paper speed and scale.
40. The student will accurately record left heart pressures using proper paper speed and scale.
41. The student will accurately recognize pressure waveform configurations.
42. The student will recognize and report arrhythmias immediately to the proper personnel.
43. The student will accurately recognize deviations in heart rate and arterial pressures during a performed procedure.
44. The student will accurately calculate shunt, resistance to flow, cardiac output, and valve areas.
45. The student shall report to the designated laboratory ready for work at the appropriate time.
46. The student should ask questions when in doubt at the appropriate time.
47. The student will handle personal and professional frustrations appropriately and at all times.
48. The student will modify behavior accordingly in response to supervision.
49. The student should recognize self strengths and weaknesses and be able to adjust accordingly.

50. The student should share in the responsibility in maintaining laboratory environment in a manner conducive to efficiency and safety.
51. The student should accept constructive criticism well.
52. The student should utilize time wisely.
53. The student should remain calm and efficient during an emergency.
54. The student should use professional judgement in selecting interpreting, and reporting all gathered laboratory data.
55. The student should communicate effectively with the staff.
56. The student should will demonstrate professional telephone skills.
57. The student will check patient identification by verbally verifying the patient's name and by checking the patient's armband.
58. The student will check the patient chart to verify the physician's order for a designated procedure.
59. The student will interview the patient correctly according to standard laboratory procedure.
60. The student will accurately gather and record patient's vital signs.
61. The student will accurately describe the standard pediatric cardiac catheterization techniques.
62. The student will accurately recognize normal pediatric intracardiac and vessel pressures.
63. The student will accurately recognize normal pediatric intracardiac and vessel oxygen saturations.
64. The student will understand pediatric radiation safety and dosage.
65. The student will describe and differentiate the common cyanotic and acyanotic cardiac abnormalities.
66. The student will recognize common palliative and corrective surgical techniques for cardiac abnormalities.
67. The student will recognize the indications for electrophysiology studies.
68. The student will recognize pediatric cardiac anatomy during a catheterization procedure.
69. The student will accurately correlate angiographic and clinical findings.
70. The student will describe the purpose of the Rashkind procedure.
71. The student will describe the purpose of valvuloplasty.

72. The student will accurately describe pre and post-catheterization care of the pediatric patient.
73. The student will verify the physician order for time, date, and conditions for an arterial blood gas sample.
74. The student will gather the appropriate materials for an arterial blood gas sample according to standard laboratory procedure.
75. The student shall be able to perform the Allen's test correctly.
76. The student will be able to perform the collection of an arterial blood gas according to the standard laboratory procedure.
77. Once an arterial blood gas sample is taken, the student will accurately prepare and label the sample according to standard laboratory procedure.
78. The student will accurately fill out a sample requisition form providing all the pertinent information at the time of collection according to standard laboratory procedure.
79. The student will correlate the clinical picture with the blood gas results.
80. The student will identify metabolic and respiratory acid/base imbalances.
81. The student will comprehend hypoxemia due to V/Q abnormalities.
82. The student will demonstrate the significance of body temperature and hemoglobin in arterial blood gas analysis.
83. The student will understand the significance of daily quality control in the blood gas laboratory.
84. The student should understand the concept of oxygen transport.
85. The student should understand the P-50 and oxyhemoglobin dissociation curve.
86. The student shall calibrate, analyze, and maintain blood gas analyzer according to standard laboratory procedure.

CARDIOVASCULAR INSTRUMENTATION - NONINVASIVE SECTION

1. The student will recognize the basic principles of electrocardiography.
2. The student will accurately identify cardiac rhythm disturbances.
3. The student accurately describes cardiac rhythm disturbances.
4. The student recognizes physical symptoms of ischemia.

5. The student will differentiate clinical symptoms of a positive stress-test from a negative stress-test.
6. The student will know the indications and contraindications to stress-testing.
7. The student will know the indications and contraindications to Thallium stress-testing.
8. The student will summarize the conventional indications for echocardiography.
9. The student accurately identifies standard 2-D positions according to the American Society of Echocardiography.
10. The student will recognize left ventricular wall dysfunction.
11. The student will differentiate valvular stenoses from valvular insufficiencies.
12. The student will recognize pericardial effusion.
13. The student recognizes various other acquired and congenital cardiac pathologies.
14. The student can describe the purpose of Doppler Echocardiography.
15. The student recognized normal Doppler blood flow patterns.
16. The student can identify abnormal blood flow patterns using pulsed and continuous wave Doppler systems.
17. The student can describe the advantages and disadvantages of using pulsed and continuous wave Doppler systems.
18. The student can describe the purpose and principles involved in Holter Monitoring.
19. The student recognizes the indications for pacemaker implantation.
20. The student can differentiate the rationale for permanent and temporary pacemaker therapy.
21. The student can recognize various normal and abnormal pacemaker rhythms.
22. The student can efficiently and correctly perform instrumentation checks to insure proper function during a stress-test.
23. The student can explain a procedure to a patient using a clear and simple dialogue.
24. The student can obtain a patient signature and properly fill out the patient consent form.
25. The student can apply skin electrodes according to standard laboratory procedure within a reasonable time period.
26. The student can efficiently collect all pertinent patient preliminary data according to standard laboratory procedure.

27. The student can accurately perform a pretest ECG according to standard laboratory procedure.
28. The student can accurately calculate a patient's target heart rate according to standard laboratory procedure.
29. The student can accurately and efficiently record heart rate, blood pressure, and ECG readings during a stress-test according to standard laboratory procedure.
30. The student will remain alert to any changes in patient data during a designated procedure.
31. The student can motivate the patient during a designated procedure using a professional manner.
32. The student can accurately monitor a patient after a designated procedure.
33. The student will remove skin electrode without extreme patient discomfort.
34. The student will instruct the patient in post-test care according to standard laboratory procedure.
35. The student will explain the Holter Monitoring recorder operation to the patient, using a clear and concise dialogue.
36. The student will explain the maintenance of the patient diary when using the Holter Monitor.
37. The student will accurately attach the skin electrodes to the patient for Holter Monitoring according to standard laboratory procedure.
38. The student will appoint a return time for the patient and accurately record this information in an appointment book and with the patient.
39. Upon return to the laboratory, the student will accurately collect all patient data, check the patient's diary, and properly remove the skin electrodes.
40. The student will accurately process all the data for the Holter Monitoring according to standard laboratory procedure.
41. The student will explain the echocardiographic procedure to the patient using clear and simple dialogue.
42. The student will apply the ECG electrodes to the patient and position the patient for the echocardiographic procedure according to standard laboratory procedure.
43. The student will perform preliminary auscultation prior to the echocardiographic tracing.
44. The student will set the controls to obtain optimal echo recordings.
45. The student will accurately identify and locate the appropriate views and cardiac structures in the 2-D parasternal views.

46. The student can locate and accurately identify structures in the apical views.
47. The student can accurately identify and locate cardiac structures in the subcostal views.
48. The student can accurately identify M-mode anatomy.
49. The student can accurately record appropriate M-mode studies.
50. The student can identify and record continuous wave Doppler in the appropriate areas and views.
51. The student can identify and record pulsed Doppler in the appropriate areas and views.
52. The student shall accurately perform Doppler measurements according to standard lab procedure.
53. The student will efficiently prepare collected data from an actual echocardiogram for a physician interpretation according to standard laboratory procedure.
54. The student will report to the laboratory ready for work and at the appropriate time.
55. The student will ask questions when in doubt and in a professional manner at the appropriate time.
56. The student is expected to handle personal and professional frustrations appropriately.
57. The student will modify behavior accordingly in response to supervision.
58. The student should recognize strengths and weaknesses and act accordingly.
59. The student shares in the responsibility of maintaining laboratory environment in a manner conducive to efficiency and safety.
60. The student will accept constructive criticism well.
61. The student should utilize time wisely.
62. The student will remain calm and efficient during an emergency.
63. The student should use professional judgement in selecting, interpreting, and reporting data.
64. The student should strive to communicate effectively with patients at all times.
65. The student should strive to communicate effectively with the staff at all times.
66. The student shall present written reports according to standard laboratory procedure.
67. The student shall recognize and utilize non-verbal behavior.
68. The student shall demonstrate professional telephone skills.

69. The student shall demonstrate the ability to relieve patient apprehension and anxiety.
70. When doing designated procedure, the student shall check the patient identification by verbally verifying the patient's name and by checking the armband.
71. The student shall check the patient chart to verify a physician's order prior to doing a designated procedure.
72. If applicable, the student should check the patient chart to verify that appropriate pre-test medications were administered.
73. The student shall professionally interview the patient prior to a designated procedure according to standard laboratory procedure.
74. The student shall collect and record pertinent patient data from the chart.
75. The student shall accurately gather and record patient's vital signs prior to performing the designated procedure.

CARDIOVASCULAR PRACTICUM***

1. To familiarize the student with basic procedures performed in noninvasive, invasive, and peripheral vascular study laboratories.
2. To demonstrate the ability to report to a clinical rotation promptly, work with members of a functioning cardiovascular laboratory, and to assist in the basic operations of noninvasive, invasive, and peripheral cardiovascular laboratories.
3. To demonstrate the ability to wear proper clinical attire to the assigned rotations.
4. To work with members of a functioning cardiovascular laboratory in a professional manner.
5. To assist in the basic operations of noninvasive, invasive, and peripheral cardiovascular laboratories as assigned.
6. To introduce and familiarize to the student the techniques of physical examination.
7. To demonstrate proper procedures for patient identification, taking vital signs, and listening to heart and lung sounds.

*** According to the chronological sequence of the curriculum, the next section should be the objectives for the peripheral noninvasive cardiovascular course, but this section of objectives will be presented in Section 4 in the form of objective checklists. See Section 4.

SECTION 4

SAMPLE CLINICAL CHECKLISTS FOR EVALUATION OF
STUDENT PERFORMANCES IN PERIPHERAL NONINVASIVE
CARDIOVASCULAR TECHNOLOGY

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

I. Stress Testing - Treadmill Exercise:

	Ongoing Evaluation	Ongoing Evaluation	Final Evaluation
	Pass/Fail Not Observed	Pass/Fail Not Observed	1-2-3-4-5 (or not observed)
01 Positions the patient bed or examining table adjacent to the motor-driven treadmill.			
02 Presets the treadmill at 2 miles/hour at a 12% grade. Utilizes a speed of 1 mile/hour for patients whose debility or disability precludes higher speeds.			
03 Positions the patient in a supine position on the examination table and allows 15 minutes to pass before proceeding to step four.			
04 Accurately measures and records the patient's brachial and ankle systolic blood pressures.			
05 Identifies the higher of the two pressures measured in each limb and records that measurement as a baseline value. Notes the anatomic location of the baseline value.			
06 Removes the cuffs and marks the patient limb to indicate the best probe position on each limb in order to aid in finding the vessel when the flow is decreased.			
07 Properly describes the remaining portion of the procedure to the patient using terms that are easily understandable.			
08 When indicated, properly attaches the patient to an electrocardiographic monitor being sure to position the connecting cables out of the path of the patient.			
09 Positions the EKG monitor so that it can be easily viewed by the examiner during the entire procedure.			
10 Positions himself/herself to be able to assist the patient as they prepare to step onto the moving treadmill.			
11 Continues the test until the patient reaches their maximum degree of claudication or until 5 minutes have passed.			
12 During the procedure, does not allow the patient to lean on the support bar or interrupt their normal gait.			
13 Immediately stops the procedure if the signs of dyspnea, angina, excessive heartrate, extrasystoles, or major changes in the ST segment or T wave occur.			
14 Assists patient off of treadmill and back onto examination table as quickly as possible. Positions blood pressure cuffs above malleoli on each limb. Uses a separate sphygmomanometer for each leg.			
15 Records Doppler ankle pressures on each limb at 30 second intervals for the first 4 minutes and a 1 minute intervals from the 5th to 10th minute.			
16 Records ankle pressures in terms of the ankle index (ratio of ankle to brachial pressures). Graphs ankle index vs. time, noting any drop in the ankle index as representing arterial occlusion.			

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

III: Stress Testing - Reactive Hyperemia Method

	Ongoing Evaluation	Ongoing Evaluation	Final Evaluation
	Pass/Fail Not Observed	Pass/Fail Not Observed	1-2-3-4-5 (or not observed)
01 Positions the patient in a supine position on the examination table and allows 15 minutes to pass before proceeding to step two.			
02 Accurately measures and records the patient's brachial and ankle systolic blood pressures.			
03 Identifies the higher of the two pressures measured in each limb and records that measurement as a baseline value. Notes the anatomic location of the baseline value.			
04 With the ankle cuffs left in place, applies thigh cuffs (19 cm wide) at a midhigh level to each leg.			
05 Assists the patient in the elevation of their legs to a 45 degree angle.			
06 While the patient's legs are elevated, inflates the thigh cuffs to a pressure of 50 mm Hg higher than the brachial systolic pressure.			
07 Once the thigh cuffs are inflated, lowers the patient's legs down onto the examination table.			
08 Monitors the pressure in the thigh cuffs continuously, adding air in the presence of any slow leaks.			
09 Monitors the patient for a tolerable degree of discomfort. Discontinues the test if significant ischemic pain reported.			
10 Simultaneously deflates the thigh cuffs at the end of five minutes of inflation.			
11 Records Doppler ankle pressures on each limb at 30 second intervals for the first 4 minutes and a 1 minute intervals from the 5th to 10th minute, unless normal values have reappeared.			
12 Records ankle pressure in terms of the ankle index (ratio of ankle pressures to brachial pressures).			
13 Graphs ankle index vs. minutes after stress.			
14 Notes that a normal test is one in which (1) the lowest ankle index is greater than 0.80 and (2) the ankle index returns to 90% of the baseline value within 1 minute following release of cuff pressures.			
15 Also notes that in patients with minimal or mild claudication, the ankle index will reach 80 to 90% recovery in the 1st minute. Slower recovery is reflective of significant arterial disease.			
Total Final Score:			

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

III. SEGMENTAL LIMB PRESSURES: LOWER EXTREMITY

	Ongoing Evaluation	Ongoing Evaluation	Final Evaluation
	Pass/Fail Not Observed	Pass/Fail Not Observed	1-2-3-4-5 (or not observed)
01 Ensures that the patient has not walked or climbed any stairs in the last 15 minutes. Ideally patient should rest 20-30 minutes prior to the examination.			
02 Places the patient in a supine position on a bed or examining table.			
03 Bilaterally measures the brachial artery pressure and accurately records the results.			
04 Applies appropriately sized arm cuffs to each arm (bladder dimension 12 x 40 cms).			
05 Palpates the brachial artery in the antecubital fossa, and applies a small amount of acoustic gel to the site. Lightly applies the probe tip to the patient's skin.			
06 Locates the arterial signal in each arm using the Doppler probe held at a 60 degree angle pointed opposite the direction of blood flow, and then inflates each cuff until the signal disappears.			
07 Keeping the Doppler probe in a stationary position, slowly deflates the cuff and records the arterial pressure when the arterial signal reappears.			
08 Next, applies four 12x40 cm pneumatic cuffs to each leg in a high thigh, above the knee, below the knee, and ankle cuff position.			
09 Using the Doppler probe, properly locates and listens to the posterior tibial, dorsalis pedis, lateral tarsal, popliteal and digital arteries.			
10 Selects the vessel with the strongest Doppler signal. If none of the vessels can be located, the popliteal artery signal is identified in the popliteal fossa.			
11 Determines and records the high thigh pressure by inflating the properly sized high-thigh cuff until the Doppler signal disappears and then slowly deflates the cuff until the Doppler signal returns.			
12 In the same manner, above-knee, below-knee, and ankle pressures are determined & recorded. If no arterial signal is audible at the ankle, the 2 thigh pressures may be determined with the Doppler probe over the popliteal artery.			
13 Toe pressures are measured with a photoplethysmograph transducer, using a small pneumatic cuff made from a 2.5 cm Penrose drain with Velcro backing, placed around the proximal phalanx of the first toe.			
14 Recognizes the limitations of the Doppler signal and properly utilizes photoplethysmographic techniques when indicated.			
Total Final Score:			

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

IV. SEGMENTAL LIMB PRESSURES: UPPER EXTREMITY

	Ongoing Evaluation	Ongoing Evaluation	Final Evaluation
	Pass/Fail Not Observed	Pass/Fail Not Observed	1-2-3-4-5 (or not observed)
01 Places the patient in a supine position on a bed or examining table. Mildly abducts and externally rotates the patient's arm.			
02 Bilaterally measures the brachial artery pressure and accurately records the results.			
03 Applies appropriately sized arm cuffs (bladder dimension 12 x 40 cms) on the upper arm.			
04 Applies appropriately sized arm cuffs (bladder dimension 10 x 40 cms) to the upper forearm.			
05 Palpates the brachial artery in the antecubital fossa, and applies a small amount of acoustic gel to the site. Using the Doppler probe, locates the arterial signal.			
06 Palpates the radial and ulnar arteries, and applies a small amount of acoustic gel to the site. Using the Doppler probe, locates the strongest arterial signal.			
07 Locates the strongest arterial signal in each arm using the Doppler probe and then inflates each cuff until the signal disappears.			
08 Keeping the Doppler probe in a stationary position, slowly deflates the cuff and records the arterial pressure when the arterial signal reappears.			
09 A small pneumatic cuff made from a 2.5 cm Penrose drain with Velcro backing is placed just distal to the metacarpalphalangeal joint.			
10 Finger pressures are measured with a Photoplethysmograph (PPG) transducer properly attached (with adhesive cellophane tape) to the palmar aspect of the distal phalanx of the forefinger.			
11 Determines and records the finger pressure by inflating the properly sized cuff until the PPG signal disappears and then slowly deflates the cuff until the signal returns.			
12 Recognizes the limitations of the Doppler signal and properly utilizes photoplethysmographic techniques when indicated.			
Notes on proper selection of arterial sites: Subclavian: Position the probe in the supraclavicular fossa. Brachial: Evaluated proximally near the axilla and distally at the antecubital fossa. Radial and Ulnar: Examined on the volar aspect of the wrist. Superficial Palmar Arch: Studied by detecting the flow at the level of the distal palmar crease. To evaluate the patency of the palmar arch, the ulnar artery and then the radial artery are alternately compressed while the probe is placed over the arch. Palmar Digital Arteries: Traced along the medial & lateral aspects of each digit.			
Total Final Score:			

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

V. OPHTHOSONOMETRY (OSM): DETECTION OF OPHTHALMIC ARTERY FLOW

	Ongoing Evaluation	Ongoing Evaluation	Final Evaluation
	Pass/Fail Not Observed	Pass/Fail Not Observed	1-2-3-4-5 (or not observed)
01 Properly explains the purpose and effects of the procedure, assuring the patient that the test is harmless and painless.			
02 Places the patient in a supine position on a bed or examining table with the patient's head comfortably positioned on a pillow.			
03 Examiner takes a position behind the patient, with the Doppler equipment and controls conveniently located and visible while the testing is in progress.			
04 Locates the frontal artery by properly applying the Doppler probe in the inner canthus of the eye and seeks the loudest audible signal with arterial characteristics.			
05 Carefully positions the probe to achieve maximum amplitude on the strip-chart recorder together with the greatest displacement on the velocity meter.			
06 Advances the probe tip a few millimeters into the orbit while maintaining the same relative probe position parallel to the nose.			
07 When physical anomaly of the frontal artery is present, or when data from the frontal artery is inconclusive, locates the supraorbital artery by palpating its pulsation approximately one thumb width lateral to the inner canthus.			
08 Continuously maintains the proper probe pressure during the compressive maneuver.			
09 Continuously holds the probe in the hand opposite the side being studied and keeps the palm of that hand resting on the side of the forehead opposite the side being examined.			
10 Does not compress the vessels above the artery being examined to avoid alteration of flow patterns from the external carotid artery.			
11 Rests the ring or middle finger on the patient's nose, forming a bridge with the palm and the other fingers throughout the procedure. Holds the probe with three fingers in a triangular position, with the index and middle finger opposing the thumb.			
12 Utilizes the middle finger of thumb of the hand holding the probe to operate the reversing switch located on the probe.			
13 Utilizes the non-probe holding hand to perform all compressive maneuvers of the external carotid branches.			
14 Recognizes the limitations of ophthalmosonometry & recommends alternate forms of noninvasive examination when indicated.			
Total Final Score:			

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

VI . PHOTOPLETHEYSMOGRAPHY (PPG): DETECTION OF OPHTHALMIC ARTERY FLOW

	Ongoing Evaluation	Ongoing Evaluation	Final Evaluation 1-2-3-4-5 (or not observed)
	Pass/Fail Not Observed	Pass/Fail Not Observed	Pass/Fail Not Observed
01 Properly explains the purpose and effects of the procedure, assuring the patient that the test is harmless and painless.			
02 Places the patient in a supine position on a bed or examining table with the patient's head comfortably positioned on a pillow (pt.'s choice prevails).			
03 Examiner attaches PPG probe on the patient's forehead with double-stick tape, taking care that the forehead is clean and free of scar tissue.			
04 Examiner takes a position behind the patient, with the PPG equipment and controls conveniently located and visible while the testing is in progress.			
05 Checks to see that the amplitude of the PPG signal is similar on both sides.			
06 Covers the PPG probes with a dark cloth to prevent interference from incidental light.			
07 Locates the frontal artery by properly applying the PPG probe in the inner canthus of the eye and seeks the loudest audible signal with arterial characteristics.			
08 When physical anomaly of the frontal artery is present, or when data from the frontal artery is inconclusive, locates the supraorbital artery by palpating its pulsation approximately one thumb width lateral to the inner canthus.			
09 Does not compress the vessels above the artery being examined to avoid alteration of flow patterns from the external carotid artery.			
10 Utilizes either hand to perform all manual compressive maneuvers of the external carotid branches to include the superficial temporal, facial, and infraorbital arteries.			
11 Manually compresses the right, then left, external carotid artery to check for internal carotid stenosis or occlusion.			
12 Manually compresses the low common carotid artery to assess the patency of the circle of Willis.			
13 Simultaneously compresses the superficial temporal arteries and branches of the external carotid arteries and records the changes in the PPG readings.			
14 Recognizes the limitations of photoplethysmography and recommends alternate forms of noninvasive examination when indicated.			
Total Final Score:			

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

VII-A. PERIPHERAL ARTERY DOPPLER BLOOD FLOW ANALYSIS: PEDAL ARTERY

		Ongoing Evaluation	Ongoing Evaluation	Final Evaluation
		Pass/Fail Not Observed	Pass/Fail Not Observed	1-2-3-4-5 (or not observed)
01	Ensures that the patient has not walked or climbed any stairs in the last 15 minutes. Ideally patient should rest 20-30 minutes prior to the examination.			
02	Places the patient in a supine position on a bed or examining table. Checks that patient hasn't smoked a cigarette for last 60 minutes & that room temp is 20 to 22 degrees C.			
03	Bilaterally measures the brachial artery systolic and diastolic pressures and accurately records the results. Delays examination and contacts area supervisor or attending physician if abnormal results obtained.			
04	Applies an 8 to 10-MHz probe (since arteries are superficial) to the dorsalis pedis artery just lateral to the tendon of the extensor hallucis longus.			
05	Slightly adjusts the probe position to obtain and record the most representative Doppler signal as judged by the audio output and the display of the Doppler wave form.			
06	Selects the correct probe movement and probe/vessel angle when attempting to maximize the Doppler signal.			
07	Takes recordings from the artery in the 4-cm segment just distal to the ankle joint but proximal to the bifurcation of the vessel.			
08	Locates the posterior tibial artery 0.5-1 cm behind the medial malleolus. Initiates a recording at this level or just proximal to it. Eliminates any troublesome venous flow by repositioning the probe or gently compressing the venous flow using opposite hand digital pressure.			
09	Repeats the studies of the posterior and anterior tibial arteries if their wave forms are abnormal +/- or asymmetric. Compresses the opposite vessel during the repeat study. (Recalls that if either artery is occluded proximally and is filling from below through the plantar arch, pressure on the opposite vessel may reverse the flow.)			
10	Takes Recordings from the distal branch of the peroneal artery if the patient has severe tibial artery disease.			
11	Also notes the presence of any dense scar tissue, hematomas from an arteriogram, atherosclerotic plaque on the vessel's anterior wall or excessive obesity which may make accurate recordings impossible.			
12	Recognizes the limitations of the Doppler signal. Reports any difficulties to a supervisor or attending physician.			
Comments:		Total Final Score:		

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

VII-B. PHERIPHERAL ARTERY DOPPLER BLOOD FLOW ANALYSIS: FEMORAL ARTERY

Technical Skills:			
VII-B. PHERIPHERAL ARTERY DOPPLER BLOOD FLOW ANALYSIS: FEMORAL ARTERY	Ongoing Evaluation	Ongoing Evaluation	Final Evaluation
	Pass/Fail	Pass/Fail	1-2-3-4-5 (or not observed)
	Not Observed	Not Observed	
01 Ensures that the patient has not walked or climbed any stairs in the last 15 minutes. Ideally patient should rest 20-30 minutes prior to the examination.			
02 Places the patient in a supine position on a bed or examining table. Checks that patient hasn't smoked a cigarette for last 60 minutes & that room temp is 20 to 22 degrees C.			
03 Bilaterally measures the brachial artery systolic and diastolic pressures and accurately records the results. Delays examination and contacts area supervisor or attending physician if abnormal results obtained.			
04 If palpable, applies a 5-MHz probe (not used with thin patients) to the common femoral artery at a site just below the inguinal ligament and the midpoint of a line joining the anterior superior iliac spine and the pubic tubercle.			
05 May use the femoral vein as a guide to locate the common femoral artery, (noting the continuous signal of the vein with blood flow toward the heart) and once located, moves the probe laterally about 1 cm to locate the common femoral artery.			
06 Slightly adjusts the probe position to obtain and record the most representative Doppler signal as judged by the audio output and the display of the Doppler wave form.			
07 Selects the correct probe movement and probe/vessel angle when attempting to maximize the Doppler signal.			
08 Repeats the above recording at a second site in the common femoral artery to insure that a representative wave form is obtained. Recalls and notes any nonrepeatable results between the high and low femoral artery recordings (usually indicates atherosclerotic plaque in the common femoral artery).			
09 Also notes the presence of any dense scar tissue, hematomas from an arteriogram, atherosclerotic plaque on the vessel's anterior wall or excessive obesity which may make accurate recordings impossible.			
10 Recognizes the limitations of the Doppler signal. Reports any difficulties to a supervisor or attending physician.			
Comments:			
Total Final Score:			

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

VII-C. PERIPHERAL ARTERY DOPPLER BLOOD FLOW ANALYSIS: POPLITEAL ARTERY

		Ongoing Evaluation	Ongoing Evaluation	Final Evaluation
		Pass/Fail	Pass/Fail	1-2-3-4-5 (or not observed)
	Not Observed	Not Observed	Not Observed	
01	Ensures that the patient has not walked or climbed any stairs in the last 15 minutes. Ideally patient should rest 20-30 minutes prior to the examination.			
02	Measures the brachial artery systolic and diastolic pressures and accurately records the results. Delays examination and contacts area supervisor or attending physician if abnormal results obtained.			
03	Places the patient in a prone position on a bed or examining table, with knees flexed approximately 10 degrees with the ankles supported on a pillow.			
04	Applies a 5-MHz probe at the midpoint of the popliteal fossa to locate the popliteal artery.			
05	Slightly adjusts the probe position to obtain and record the most representative Doppler signal as judged by the audio output and the display of the Doppler wave form.			
06	Selects the correct probe movement and probe/vessel angle when attempting to maximize the Doppler signal.			
07	Takes recordings from the artery in the 4-cm segment just distal to the ankle joint but proximal to the bifurcation of the vessel.			
08	Locates the posterior tibial artery 0.5-1 cm behind the medial malleolus. Initiates a recording at this level or just proximal to it. Eliminates any troublesome venous flow by repositioning the probe or gently compressing the venous flow using opposite hand digital pressure.			
09	If difficult to obtain a consistent wave form, or if turbulence appears on the wave form, repeats the studies of the popliteal artery at a site above and below the knee to determine whether there is atherosclerotic involvement of the popliteal artery.			
10	Also notes the presence of any dense scar tissue, hematomas from an arteriogram, atherosclerotic plaque on the vessel's anterior wall or excessive obesity which may make accurate recordings impossible.			
11	Recognizes the limitations of the Doppler signal. Reports any difficulties to a supervisor or attending physician.			
Comments:		Total Final Score:		

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

VII-D. PERIPHERAL ARTERY DOPPLER BLOOD FLOW ANALYSIS: ARTERIAL GRAFTS

	Ongoing Evaluation	Ongoing Evaluation	Final Evaluation
	Pass/Fail Not Observed	Pass/Fail Not Observed	1-2-3-4-5 (or not observed)
01 Ensures that the patient has not walked or climbed any stairs in the last 15 minutes. Ideally patient should rest 20-30 minutes prior to the examination.			
02 Places the patient in a supine position on a bed or examining table. Checks that patient hasn't smoked a cigarette for last 60 minutes & that room temp is 20 to 22 degrees C.			
03 Bilaterally measures the brachial artery systolic and diastolic pressures and accurately records the results. Delays examination and contacts area supervisor or attending physician if abnormal results obtained.			
04 If palpable, applies a 5-MHz probe (not used with thin patients) to the femoral-popliteal or femoral-tibial saphenous vein bypass grafts. Notes that it is usually not possible to obtain useful recordings with plastic prostheses.			
05 May use the femoral vein as a guide to locate the common femoral artery, (noting the continuous signal of the vein with blood flow toward the heart) and once located, moves the probe laterally about 1 cm to locate the common femoral artery.			
06 Slightly adjusts the probe position to obtain and record the most representative Doppler signal as judged by the audio output and the display of the Doppler wave form.			
07 Selects the correct probe movement and probe/vessel angle when attempting to maximize the Doppler signal.			
08 Repeats the above recording at a second, third, and fourth site along the above mentioned grafts to insure that there are no stenoses in the graft.			
09 Also notes the presence of any dense scar tissue, hematomas from an arteriogram, atherosclerotic plaque on the vessel's anterior wall or excessive obesity which may make accurate recordings impossible.			
10 Recognizes the limitations of the Doppler signal. Reports any difficulties to a supervisor or attending physician.			
Comments:			
Total Final Score:			

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

VIII. SEGMENTAL VOLUME PLETHYSMOGRAPHY: PULSE VOLUME RECORDER (PVR)

	Ongoing Evaluation	Ongoing Evaluation	Final Evaluation
	Pass/Fail Not Observed	Pass/Fail Not Observed	1-2-3-4-5 (or not observed)
01 Ensures that the patient has not walked or climbed any stairs in the last 15 minutes. Ideally patient should rest 20-30 minutes prior to the examination.			
02 Places the patient in a supine position on a bed or examining table, with heels slightly elevated on a cushion.			
03 Briefly explains the procedure to the patient while placing a tapered thigh cuff as close to the groin as possible. Snugly wraps the cuff around the extremity.			
04 Applies appropriately sized cuffs to the calf and ankle, with steps 3 & 4 repeated on the contralateral extremity.			
05 With a Doppler velocity detector, segmental limb pressures are recorded in both arms and in at least three levels of each lower extremity.			
06 Next connects the thigh cuff to the monitor post on the pulse volume recorder (PVR) using flexible connecting tubing.			
07 Sets the mode switch for "Art" (arterial) and "Inf" (inflate) and a "Gain" setting of 1 (one) is selected.			
08 If using a PVR with an automatic inflation capability, the "Thigh" button is depressed and the "Inflate" control depressed until the aneroid gauge on the PVR reaches a cuff pressure of 65 mm Hg.			
09 Cuff volume of 400 (+/- 75) cc's achieved, or the cuff is deflated, rewrapped, and step 08 repeated.			
10 Once the thigh cuff is satisfactorily inflated, the "Rec" mode is depressed, and the strip recorder set at 25 mm/second. A "Gain" of <1 is used if pulse volume recordings are too large for the graph paper.			
11 Runs the strip recorder until a series of 3 to 5 artifact free, consistent cardiac cycles are inscribed.			
12 Activates the "Defl" (Deflate) mode button and repeats steps 6 thru 12 for each successive limb segment being studied.			
13 Inflates the calf and ankle cuffs to a pressure of 65 mm Hg with 75 (+/- 10) cc's of air. Uses a child-sized cuff if a metatarsal tracing is required with 50 cc of air and a "Gain" of 2.5. Digital cuffs are inflated to a pressure of 40 mmHg with 5 (+/- 3) cc's of air and a "Gain" of 5.			
14 Recognizes the limitations of the segmental volume plethysmography techniques and identifies potential sources of errors.			
Total Final Score:			

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

IX. OCULAR PNEUMOPLETHYSMOGRAPHY (OPG-Gee) Page One of Two

	Ongoing Evaluation	Ongoing Evaluation	Final Evaluation
	Pass/Fail Not Observed	Pass/Fail Not Observed	1-2-3-4-5 (or not observed)
01 Interviews the patient and reviews the clinical chart for pertinent information regarding symptoms of the present neurologic illness, particularly those that suggest hemispheric or vertebrobasilar arterial bruits.			
02 Any allergic reaction to plastics or local anesthetic agents are noted.			
03 If the patient is allergic to local anesthetic, asks the patient to swallow in order to clear the mouth of all saliva. Then tilts the pt's head slightly forward & with the tip of the tongue elevated to the hard palate, the pt is instructed to breath through his mouth. Once the floor of the mouth dries, applies 2 to 3 drops of 0.5% proparacaine hydrochloride without epinephrine on the floor of the mouth. Checks for any erythema in the anesthetized area. If none noted, technician then realizes that a conjunctival reaction will also not occur.			
04 Documents any history of hypertension, usage of anti-hypertensive medications, aortic insufficiency, implanted pacemaker, significant eye injuries, traumatic retinal detachment, traumatic vitreous separation, any eye surgery and glaucoma.			
05 Delays OPG-Gee exam if items in step 04 are noted which appears to contraindicate the usage of ocular pneumoplethysmography. Contacts referring physician.			
06 Measures pt's blood pressure in both arms and leaves the cuff attached to the arm that produced the higher systolic reading.			
07 Instructs the patient in the mechanics of the test, informing them of dimming vision and the complete loss of vision that may result for several seconds. Also announces the possibility of a scleral ecchymosis.			
08 Cleanses the eye cups with 70% alcohol. Dries the eyecups with a facial tissue. Prior to implimenting step 11, checks to see that the eye cups are completely dry of all alcohol.			
09 Places the patient in a supine position and announces that a cold or stinging sensation may be noticed when several drops of 0.5% proparacaine hydrochloride without epinephrine are instilled into each eye. Then instills several drops into each eye.			
10 With the patient's eyes closed, wipes both eyes carefully with a facial tissue, from medial to lateral, forcing excess drops of proparacaine HCl and tear accumulation out of the eyes.			
11 Positions the OPG-Gee transducer head over the face of the pt, with the pneumatic tubing and attached eyecups hanging at a level on a transverse plane, midway between the bridge and tip of the nose.			
12 Grasps both eyecups simultaneously between the respective thumbs and forefingers.			
XI. OCULAR PNEUMOPLETHYSMOGRAPHY (OPG-Gee) Continued on the next page.	Total Final Score:		

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

IX. OCULAR PNEUMOPLETHYSMOGRAPHY (OPG-Gee) Page Two of Two

	Ongoing Evaluation	Ongoing Evaluation	Final Evaluation
	Pass/Fail Not Observed	Pass/Fail Not Observed	1-2-3-4-5 (or not observed)
13 Rests the 4th digit of either hand on the patient's malar area while simultaneously retracting both lower eyelids downwards.			
14 Places the eyecups on the lateral sclerae and instructs the patient to look at the white disk on the bottom of the transducer head.			
15 Very precisely locates and places the eyecups over the inferolateral quadrant of the sclera, with the medial border of each cup abutting or slightly overlapping the respective limbus.			
16 Activates the vacuum footswitch once both eyecups have been properly positioned, and manually maintains a slight pressure on the eyecups to insure a seal between the eyecups and the sclera. Releases manual pressure once the vacuum holds the eyecups in place.			
17 Informs the patient that the vacuum pump automatically shuts off once the maximum vacuum (either 300 mm Hg in 3 seconds or 500 mm Hg in 5 seconds) has been achieved.			
18 Also informs the patient that the initiation of all recordings starts the gradual degradation of the scleral vacuum over a 25 to 30 second period.			
19 Activates the Record sequence by pushing the "Record" switch			
20 Properly corrects for blink artifact and poor eyecup placement.			
21 Immediately upon completion of a satisfactory OPG-Gee study, remeasures the brachial blood pressure.			
IX. OCULAR PNEUMOPLETHYSMOGRAPHY (OPG-Gee)	Total Final Score:		

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

X. OCULOPLETHYSMOGRAPHY (OPG)

	Ongoing Evaluation	Ongoing Evaluation	Final Evaluation
	Pass/Fail Not Observed	Pass/Fail Not Observed	1-2-3-4-5 (or not observed)
01 Interviews the patient and reviews the clinical chart for pertinent information regarding symptoms of the present neurologic illness, particularly those that suggest hemispheric or vertebrobasilar arterial bruits.			
02 Any allergic reaction to plastics or local anesthetic agents are noted.			
03 If the patient is allergic to local anesthetic, asks the patient to swallow in order to clear the mouth of all saliva. Then tilts the pt's head slightly forward & with the tip of the tongue elevated to the hard palate, the pt is instructed to breath through his mouth. Once the floor of the mouth dries, applies 2 to 3 drops of 0.5% proparacaine hydrochloride without epinephrine on the floor of the mouth. Checks for any erythema in the anesthetized area. If none noted, technician then realizes that a conjunctival reaction will also not occur.			
04 Documents any history of hypertension, usage of anti-hypertensive medications, aortic insufficiency, implanted pacemaker, significant eye injuries, traumatic retinal detachment, traumatic vitreous separation, any eye surgery, ocular pathology and glaucoma.			
05 Delays OPG exam if items in step 04 are noted which appears to contraindicate the usage of oculoplethysmography. Contacts physician as needed.			
06 Measures pt's blood pressure in both arms and leaves the cuff attached to the arm that produced the higher systolic reading.			
07 Instructs the patient in the mechanics of the test, while attaching the photocell clips to the patient's earlobes.			
08 Cleanses the eye cups with 70% alcohol. Dries the eyecups with a facial tissue. Prior to implimenting step 12, checks to see that the eye cups are completely dry of all alcohol.			
09 Sits the patient forward with his eyes directed downward so that the fluid-filled OPG eyecups can be applied with a minimum chance of trapping air bubbles. (If using an air-filled eyecup, places the patient in a supine position instead of sitting.)			
10 Encourages the patient to try to limit their eye movement, to gaze upon a fixed position, and not to blink.			
11 Ensures that no blockage or leakage occurs in the transmission of signals from the eyecups to the electronic sensors, or from electronic failure of the electronic system.			
12 Applies the ocular suction cups directly onto the patient's corneas using (-) 60 to (-)80 mm Hg of pressure.			
X. OCULOPLETHYSMOGRAPHY (OPG) Continued on the next page.	Total Final Score:		

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

X. OCULOPLETHYSMOGRAPHY (OPG) Page Two of Two

	Ongoing Evaluation	Ongoing Evaluation	Final Evaluation
	Pass/Fail Not Observed	Pass/Fail Not Observed	1-2-3-4-5 (or not observed)
13 Observes and records the numbers in the display windows of the oculoplethysmograph at the completion of the ear-to-ear, eye-to-eye, and eye-to-ear series.			
14 Initiates the recording of a new series of eight blink-free cardiac cycles by depressing the unit's reset-hold button.			
15 Immediately upon completion of a satisfactory OPG study, remeasures the brachial blood pressure.			
Comments:			
X. OCULOPLETHYSMOGRAPHY (OPG) Page Two of Two	Total Final Score:		

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

XI. ZIRA OCULOPLETHYSMOGRAPHY

Page One of Two

	Ongoing Evaluation	Ongoing Evaluation	Final Evaluation
	Pass/Fail	Pass/Fail	1-2-3-4-5 (or not observed)
	Not Observed	Not Observed	
01 Interviews the patient and reviews the clinical chart for pertinent information regarding symptoms of the present neurologic illness, particularly those that suggest hemispheric or vertebrobasilar arterial bruits.			
02 Any allergic reaction to plastics or local anesthetic agents are noted.			
03 If the patient is allergic to local anesthetic, asks the patient to swallow in order to clear the mouth of all saliva. Then tilts the pt's head slightly forward & with the tip of the tongue elevated to the hard palate, the pt is instructed to breath through his mouth. Once the floor of the mouth dries, applies 2 to 3 drops of 0.5% proparacaine hydrochloride without epinephrine on the floor of the mouth. Checks for any erythema in the anesthetized area. If none noted, technician then realizes that a conjunctival reaction will also not occur.			
04 Documents any history of hypertension, usage of anti-hypertensive medications, aortic insufficiency, implanted pacemaker, significant eye injuries, traumatic retinal detachment, traumatic vitreous separation, any eye surgery, ocular pathology and glaucoma.			
05 Delays OPG exam if items in step 04 are noted which appears to contraindicate the usage of oculoplethysmography. Contacts physician as needed.			
06 Measures pt's blood pressure in both arms and leaves the cuff attached to the arm that produced the higher systolic reading.			
07 Cleanses the eye cups with 70% alcohol. Dries the eyecups with a facial tissue. Prior to implimenting step 12, checks to see that the eyecups are completely dry of all alcohol.			
08 Places the patient in a supine position on an examining table and, unless contraindicated by the results in step 03, applies several drops of topical ophthalmic anesthetic solution into each of the patient's eyes.			
09 Instructs the patient in the mechanics of the test, while attaching the unit's photocell clips to the patient's earlobes.			
10 Encourages the patient to try to limit their eye movement, to gaze upon a fixed position, and not to blink.			
11 Ensures that no blockage or leakage occurs in the transmission of signals from the eyecups to the electronic sensors, or from electronic failure of the electronic system.			
12 Applies the ocular suction cups directly onto the patient's corneas using (-) 60 to (-)80 mm Hg of air suction pressure.			

XI. ZIRA OCULOPLETHYSMOGRAPHY

Continued on the next page.

Total Final
Score:

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

XI. ZIRA OCULOPLETHYSMOGRAPHY

Page two of two.

	Ongoing Evaluation	Ongoing Evaluation	Final Evaluation
	Pass/Fail Not Observed	Pass/Fail Not Observed	1-2-3-4-5 (or not observed)
13 Initiates the recording of a series of eight blink-free cardiac cycles by depressing the unit's record button.			
14 Observes and records the numbers in the display windows of the oculoplethysmograph at the completion of the ear-to-ear, eye-to-eye, and eye-to-ear series.			
15 Initiates the recording of a new series of eight blink-free cardiac cycles by depressing the unit's reset-hold button.			
16 Removes the eyecups, rotates the instrument head 180 degrees to the cross position, and repeats steps 10 to 14.			
17 Produces a technically valid test result that demonstrates a consistent pulse delay, with eye-to-eye readings not varying more than + or - 3 msec and ear-to-ear, eye-to-ear readings differing by not more than + or - 5 msec.			
18 Obtains readings that are consistent when taken with the instrument head in the normal and the cross position.			
19 Immediately upon completion of a satisfactory study, remeasures the brachial blood pressure.			
Comments:			

XI. ZIRA OCULOPLETHYSMOGRAPHY

Page two of two.

Total Final
Score:

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

XII. ULTRASONIC ARTERIOGRAPHY OF CAROTID VESSELS (HOKANSON)

	Ongoing Evaluation Pass/Fail Not Observed	Ongoing Evaluation Pass/Fail Not Observed	Final Evaluation 1-2-3-4-5 (or not observed)
01 Interviews the patient and reviews the clinical chart for pertinent information regarding symptoms of the present illness.			
02 Clearly explains to the patient the purpose of the examination and the importance of remaining as motionless as possible during the ultrasonic examination.			
03 Positions the patient in a supine position on a comfortable examination couch and inserts the anchor plate at the level of the axilla under the mattress.			
04 Patients unable to tolerate the supine positioning (e.g. COPD patients) may be placed on a trolley with their head elevated approximately 45 degrees and the anchor plate inserted again at the axilla level.			
05 Slightly hyperextends the patient's neck to give easy access to the area to be examined. Applies a large quantity of acoustic gel to the anterior border of the sternocleidomastoid muscle to insure good acoustic coupling throughout the examination.			
06 Secures the ultrasonic transducer to the transducer plate and assures that the transducer head can be easily moved over the entire area to be examined, ranging from the region of the clavicle to the angle of the jaw.			
07 Begins the examination low in the neck area over the common carotid, and adjusts the range setting to give the best-quality audio signal while the central gates of the transducer are firing.			
08 Alters the range setting throughout the examination as an adjustment for the variable depth of the vessels from the skin level.			
09 Begins the mapping of the transducer signal from this point low in the neck and notes the quality of the signal from this point's center stream locations.			
10 Continues the mapping procedure until two distinct signals are audible, identifying the bifurcation region.			
11 Identifies the external carotid artery when a time period is observed between pulses where no antegrade flow occurs.			
12 Identifies the internal carotid artery when a continuous flow signal between each pulse cycle is observed. Also notes this artery's proximity to the internal jugular vein, whose low-velocity phase signal can be easily identified.			
13 Mapping of the internal carotid artery should continue as far cephalad as possible, although most lesions occur in the first 2 cm.			
XII. ULTRASONIC ARTERIOGRAPHY OF CAROTID VESSELS Continued on the next page.	Total Final Score:		

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

XII. ULTRASONIC ARTERIOGRAPHY OF CAROTID VESSELS (HOKANSON)	Ongoing Evaluation	Ongoing Evaluation	Final Evaluation
	Pass/Fail Not Observed	Pass/Fail Not Observed	1-2-3-4-5 (or not observed)
14 Maps the external carotid artery for a distance of 1 to 2 cm or until a major branch vessel is visualized (& confirms that the carotid artery has been identified).			
15 When areas of stenosis appear to exist, listens carefully to the signal immediately distal to this area for the expected increase in frequency associated with the stenosis.			
16 If a signal distal to the area of stenosis is similar in quality to that obtained proximally, recognizes this area as a calcium plaque associated with no stenosis or a non-flow reducing lesion.			
17 If a change in frequency is noted, recognizes this area as a stenosis associated with the presence of calcium.			
18 When encountering a difficulty in identifying the internal carotid artery, compares the signals obtained from the common and external carotid. Recognizes that similar signals suggest an occlusion of the internal carotid artery.			
19 Upon completion of the examination, obtains a polaroid photo from the oscilloscope and files the photo with a note regarding the character of the signal in each of the three vessels.			
20 Properly removes all of the acoustic gel from the patient's neck and the ultrasonic transducer following the completion of the examination.			
21 Other:			
Comments:			
XII. ULTRASONIC ARTERIOGRAPHY OF CAROTID VESSELS PAGE TWO OF TWO.	Total Final Score:		

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

XIII.

DUPLEX SCANNING OF CAROTID VESSELS

	Ongoing Evaluation	Ongoing Evaluation	Final Evaluation
	Pass/Fail Not Observed	Pass/Fail Not Observed	1-2-3-4-5 (or not observed)
01 Interviews the patient and reviews the clinical chart for pertinent information regarding symptoms of the present illness.			
02 Clearly explains to the patient the purpose of the examination and the importance of remaining as motionless as possible during the examination.			
03 Positions the patient in a supine position on a comfortable examination couch and inserts the anchor plate at the level of the axilla under the mattress.			
04 Patients unable to tolerate the supine positioning (e.g. COPD patients) may be placed on a trolley with their head elevated approximately 45 degrees and the anchor plate inserted again at the axilla level.			
05 Slightly hyperextends the patient's neck to give easy access to the area to be examined. Applies a large quantity of acoustic gel to the anterior border of the sternocleidomastoid muscle to insure good acoustic coupling throughout the examination.			
06 Secures the Doppler transducer to the transducer plate and assures that the transducer head can be easily moved over the entire area to be examined, ranging from the region of the clavicle to the angle of the jaw.			
07 Begins the examination low in the neck area over the common carotid and uses B-mode scan to provide an image of that vessel. Positions the sample volume window of the Doppler in the center of the vessel's image to produce a clean, audible signal.			
08 Finely tunes the signal and makes minor adjustments in the signal setting to maximize the audio output.			
09 When satisfied with the audio signal, records the image on the videotape recorder.			
10 Moves the scan head in a cephalad direction and detects the bifurcation area in a manner similarly described for Skill XII- Ultrasonic Arteriography.			
11 Identifies the external carotid artery when a time period is observed between pulses where no antegrade flow occurs.			
12 Identifies the internal carotid artery when a continuous flow signal between each pulse cycle is observed. Also notes this artery's proximity to the internal jugular vein, whose low-velocity phase signal can be easily identified.			
13 Mapping of the internal carotid artery should continue as far cephalad as possible, although most lesions occur in the first 2 cm.			

XII. ULTRASONIC ARTERIOGRAPHY OF CAROTID VESSELS

Continued on the next page.

Total Final
Score:

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

XIII. DUPLEX SCANNING OF CAROTID VESSELS (PAGE TWO OF TWO)		Ongoing Evaluation	Ongoing Evaluation	Final Evaluation
		Pass/Fail	Pass/Fail	1-2-3-4-5 (or not observed)
		Not Observed	Not Observed	
14	Maps the external carotid artery for a distance of 1 to 2 cm or until a major branch vessel is visualized (& confirms that the carotid artery has been identified).			
15	When lesions are visualized on the B-mode scan, notes their location and obtains videotape recordings within and just downstream of the lesion. Visualizes and makes individual velocity recordings of all three carotid vessels and any occluded vessels as they appear.			
16	When areas of stenosis appear to exist, listens carefully to the signal immediately distal to this area for the expected increase in frequency associated with the stenosis.			
17	Resolves any problems with calcifications by positioning the Doppler sample volume window downstream of the area of acoustic shadowing to determine whether there is a change in the peak velocity.			
18	When encountering a difficulty in identifying the internal carotid artery, compares the signals obtained from the common and external carotid. Recognizes that similar signals suggest an occlusion of the internal carotid artery.			
19	Upon completion of the examination, compiles all recordings and files the videotape with a noteregarding the character of the signal in each of the three vessels, and appropriate comments about the patient's tolerance of the examination techniques.			
20	Properly removes all of the acoustic gel from the patient's neck and the Doppler transducer following the completion of the examination.			
Comments:				
XIII. DUPLEX SCANNING OF CAROTID VESSELS PAGE TWO OF TWO.		Total Final Score:		

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

XIV. CAROTID VELOCITY WAVE FORM ANALYSIS

	Ongoing Evaluation	Ongoing Evaluation	Final Evaluation
	Pass/Fail Not Observed	Pass/Fail Not Observed	1-2-3-4-5 (or not observed)
01 Interviews the patient and reviews the clinical chart for pertinent information regarding symptoms of the present illness, particularly those that indicate carotid artery disease.			
02 Thoroughly explains the procedure to the patient in terms understood by the patient.			
03 Places the patient in a supine position on an examining table and completely exposes the anterior cervical area.			
04 Places the pencil probe of a continuous-wave directional Doppler velocity detector over the common carotid artery medial to the sternocleidomastoid muscle just below the level of the inferior border of the thyroid cartilage.			
05 Couples the probe to the skin with acoustic gel.			
06 Places the probe at an initial angle of approximately 30 to 45 degrees to the common carotid artery.			
07 While listening to the audible signal and watching the kilohertz level on the instrument's velocity meter, slightly rocks the probe in both the anteroposterior and lateral planes until a maximized signal is obtained.			
08 Carefully holds the probe in a "downstream" position without pressing too hard on the artery so as to avoid creating an artificially produced narrowing or stenosis.			
09 Assures that the patient's head is arranged in a comfortable position so that the sternocleidomastoid muscles are relaxed and good tracings are obtained.			
10 Identifies the maximized signal by noting the highest sustained kilohertz level on the velocity meter and assures its reproducibility by removing the probe and repositioning it at the same spot with the velocity indicator plateauing at the same level.			
11 Once the maximized signal is determined, transcribes a forward velocity tracing containing at least five to six consecutive cardiac cycles onto a strip-chart recorder.			
12 Obtains velocity tracings from both the internal and external carotid arteries.			
13 Obtains a brachial artery tracing from the arm with the highest systolic pressure.			
14 Recalls that hematoma and scar tissue both interfere with the transmission of ultrasonic waves and that this procedure may not be reliable after carotid endarterectomy, anterior neck operations or cervical trauma.			
Total Final Score:			

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

XV. CAROTID PHONOANGIOGRAPHY

	Ongoing Evaluation	Ongoing Evaluation	Final Evaluation
	Pass/Fail Not Observed	Pass/Fail Not Observed	1-2-3-4-5 (or not observed)
01 Interviews the patient and reviews the clinical chart for pertinent information regarding symptoms of the present illness, particularly those that indicate carotid artery disease.			
02 Thoroughly explains the procedure to the patient in terms understood by the patient.			
03 Places the patient in a supine position on an examining table and completely exposes the anterior cervical area while only slightly hyperextending the neck so as to limit the artifact associated with muscle tension.			
04 Places the phonoangiography probe carefully against the cervical carotid artery in an attempt to identify those sound patterns associated with extracranial carotid artery disease.			
05 Makes every attempt to limit or eliminate artifact associated with environmental noise, electromagnetic interference, muscle tension in either the patient or the technician, uncontrolled breathing by the patient, or faulty equipment.			
07 Instructs the patient to stop breathing while the recording instrument is activated. Instructs them to resume their normal breathing pattern within a 15 to 20 second period of time.			
08 Recognizes the presence of high pitched bruits caused by the jet effect of blood passing through a restricted lumen of a stenosis.			
09 Notes the distinct heart sounds heard at the beginning and the end of systole, with no intervening bruit, or with one that is observed only in early systole, as insignificant stenosis with less than 40 to 50% diameter restriction.			
10 Notes any pansystolic bruits (those that are largest at the beginning of systole and smaller at the end of systole) as indicative of 40 to 60% carotid stenosis.			
11 Recognizes the general shift of the bruit's peak amplitude toward a midsystolic point as indicative of a 60 to 70% diameter narrowing.			
12 Notes that the bruit may completely disappear with stenoses greater than 85 to 90% occlusion.			
13 Pays particular attention and notes any bruits that extend beyond systole into diastole since (1) they must originate in the internal or common carotid artery, (2) they indicate a significant pressure gradient during diastole, and (3) these bruits that extend into diastole are diagnostic even after carotid endarterectomy.			
Total Final Score:			

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

XVI. DOPPLER VENOUS SURVEY: LOWER & UPPER EXTREMITIES

	Ongoing Evaluation	Ongoing Evaluation	Final Evaluation
	Pass/Fail Not Observed	Pass/Fail Not Observed	1-2-3-4-5 (or not observed)
01 Ensures that the patient has not walked or climbed any stairs in the last 15 minutes. Ideally patient should rest 20-30 minutes prior to the examination.			
02 Places the patient in a supine position on a bed or examining table.			
03 Bilaterally measures the brachial artery pressure and accurately records the results.			
04 Slightly rotates the patient's hip externally, applies a small amount of acoustic gel to the femoral site, and uses the Doppler probe to locate the femoral artery.			
05 Moves the probe medially until the venous sound is recognized by its phasic character, (which is synchronous with respirations) and its lower amplitude.			
06 Next moves the probe downward to the midthigh, where the superficial femoral vein can be examined.			
07 Does not confuse the long saphenous vein with the superficial femoral vein.			
08 Next studies the popliteal vein with the patient's leg slightly flexed and the probe directed into the popliteal fossa.			
09 Alternately, the popliteal vein may be examined with the patient in a prone position and the knee slightly flexed.			
10 Examines the posterior tibial vein by placing the probe adjacent to the posterior tibial artery behind the ankle.			
11 Examines both legs and notes any discrepancies in the signals from the two sides.			
12 In the same manner, measurements of the subclavian, axillary, and brachial veins are determined & recorded.			
13 Locates the subclavian vein by initially placing the probe immediately below the clavicle and listening for the arterial signal. Once located, moves the probe craniad until the venous signal is heard.			
14 Locates the axillary vein by holding the patient's arm in a 90-degree abduction and directing the probe alongside the artery in the axillary fold. Examines the brachial vein in the midportion of the forearm.			
15 Recognizes the limitations of the Doppler signal and properly utilizes photoplethysmographic techniques when indicated.			
Total Final Score:			

PERIPHERAL NONINVASIVE VASCULAR LABORATORY

Evaluation Scores

Technical Skills:

XVII. PHLEBORHEOGRAPHY (PRG)

	Ongoing Evaluation	Ongoing Evaluation	Final Evaluation
	Pass/Fail Not Observed	Pass/Fail Not Observed	1-2-3-4-5 (or not observed)
01 Interviews the patient and reviews the clinical chart for pertinent information regarding symptoms of the present illness, particularly those that indicate deep venous thrombosis.			
02 Thoroughly explains the procedure to the patient in terms understood by the patient.			
03 Places the patient on an examining table with the lower extremities approximately 10 degrees below the heart level and the knees gently flexed while blood pressure cuffs are applied.			
04 Places cuff 1 around the thorax, cuff two on the thigh just above the knee, and three cuffs on each leg at an upper, midleg, and ankle position. The sixth cuff is placed on the foot.			
05 Activates an automatic inflation sequence that fills the cuffs until 10 mm Hg pressure is obtained. Monitors the instruments pressure gauges.			
07 Selects a paper speed of 2.5 mm/second for venous studies and 25 mm/second for pulse tracings.			
08 Depresses the calibration button and adjusts the amplification so that a 0.2 cc loss of air from each cuff results in a 2-cm downward deflection of the recording pen.			
09 With the selector switch on "Run A" notes that the 6th cuff is used to apply pressure to the foot while the other cuffs record volume changes. Activates the "Compress" button each time a respiration is noted.			
10 At the completion of "Run A", deflates the cuffs and moves the mode switch to "Run B", reinflates the cuffs and repeats the calibration procedure. Activates the "Compress" button each time a respiration is noted.			
11 Activates the "Pulse" and "ECG" modes if desired by the attending physician.			
Comments:			
Total Final Score:			

SECTION 5
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BIBLIOGRAPHY

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ABSTRACT

85-7014: A Curriculum Guide for Cardiovascular Technologist

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The purpose of this project was to develop a generic curriculum guide for use by the public sector in the State of Pennsylvania.

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